The 24th EURL-AR Proficiency Test - Enterococci, Staphylococci and Escherichia coli 2018

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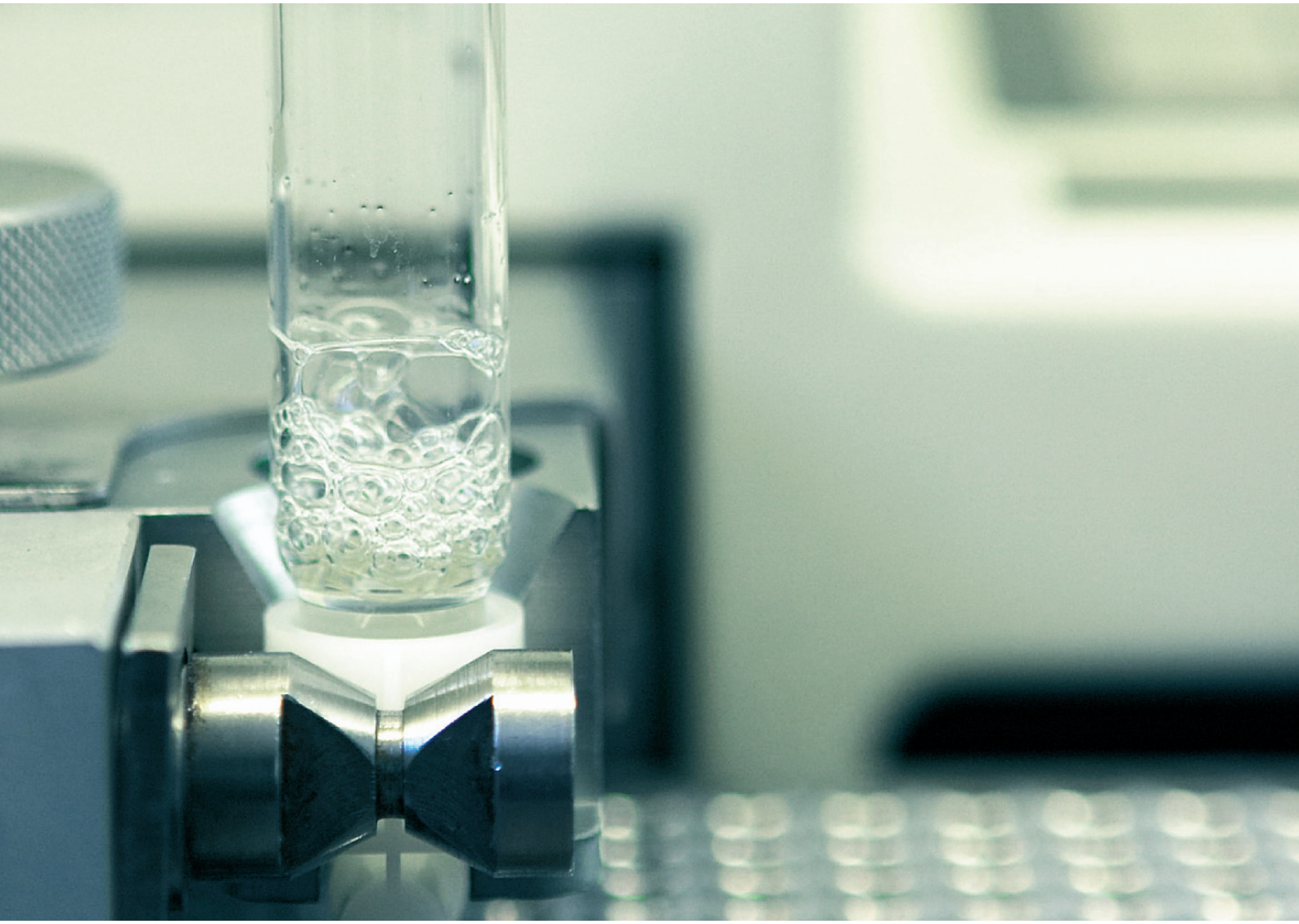

Valeria Bortolaia, Susanne Karlsmose Pedersen, Rene S. Hendriksen, Frank M. Aarestrup

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The 24th EURL-AR Proficiency Test Enterococci, Staphylococci and *Escherichia coli* - 2018

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1. Introduction

This report describes the results of the 24th proficiency test organised by the Technical University of Denmark, National Food Institute (DTU-FOOD) as the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR). This proficiency test focuses on antimicrobial susceptibility testing (AST) of enterococci, staphylococci and *Escherichia coli.* It is the 11th External Quality Assurance System (EQAS) conducted for AST of these microorganisms.

The aim of this EQAS is to: i) monitor the quality of AST results produced by National Reference Laboratories (NRL-AR), ii) identify laboratories which may need assistance to improve their performance in AST, and iii) determine possible topics for future research and collaboration.

When reading this report, please consider:

1) Expected results were generated by performing Minimum Inhibitory Concentration (MIC) determination on two occasions at DTU-FOOD. These results were verified by the United States Food and Drug Administration (FDA), Centre for Veterinary Medicine. Finally, MIC determination was performed at DTU-FOOD after preparation of the agar stab cultures to be shipped to participants to confirm that the vials contained the correct strains with the expected MIC values.

2) The evaluation is based on interpretation of MIC values obtained in agreement with i) the method reported in Decision 2013/652/EU, for testing of *E. coli* and enterococci; and ii) the most recent recommendations from EFSA, for testing of staphylococci (EFSA, 2012). Participants were requested to apply the same method used when generating AST results to be reported to EFSA. This request was made to ensure compliance with the main objective of this EQAS "to assess and improve the comparability of antimicrobial susceptibility data reported to EFSA by the different NRLs", as stated in the protocol (Appendix 4).

3) Only results obtained by MIC determination methods were allowed in this EQAS to comply with Decision 2013/652/EU. Thus, the set-up of the database for reporting results did not allow upload of disk diffusion results.

4) Laboratory performance is considered acceptable if there are < 5% deviations from expected results, as previously agreed by the EURL-AR network.

Evaluation of a result as "deviating from the expected interpretation" should be carefully analysed in a self-evaluation procedure performed by individual participants when the EQAS results are disclosed. MIC determination methods have limitations in reproducibility. Thus, on repeated testing, the same strain/antimicrobial combination can result in two MIC values differing by one-fold dilution. If the expected MIC is close to the breakpoint value for categorising the strain as susceptible or resistant, a one-fold dilution difference may result in different interpretations. Since this report evaluates the interpretations of MIC values, some participants may find their results classified as wrong even though the actual MIC measured is only one-fold dilution different from the expected MIC. In these cases (hereafter defined "one-fold dilution issues"), the participants should be confident about the good quality of their AST performance. At the EURL-AR, we strive to select test strains with MIC values distant from the breakpoints for resistance to avoid these ambiguous situations, though this is not always feasible for all strains and antimicrobial combinations. For this reason, the EURL-AR network unanimously established in 2008 that, if there are less than 75% correct results for a specific strain/antimicrobial combination, these results may be subtracted

from the evaluation report after a case by case evaluation to be detailed in the report.

This report is approved in its final version by a technical advisory group composed by competent representatives from all NRLs who meet yearly at the EURL-AR workshop.

All conclusions presented in this report are publicly available. However, participating laboratories are identified by codes and each code is known only to the corresponding laboratory. The full list of laboratory codes is confidential information known only by relevant representatives of the EURL-AR and the EU Commission.

The EURL-AR is accredited by DANAK as provider of proficiency testing (accreditation no. 516); working with zoonotic pathogens and indicator organisms as bacterial isolates (identification, serotyping and antimicrobial susceptibility testing).

2. Materials and Methods

2.1 Participants in EQAS 2018

A pre-notification to announce the EQAS 2018 on AST of enterococci, staphylococci and *E. coli* (Appendix 1) was sent by e-mail on the 16th April 2018 to the designated NRL-AR in the network and to eleven additional laboratories in Denmark, Iceland, Israel, the Netherlands, North Macedonia, Norway, Serbia, Spain, Switzerland, Turkey and United Kingdom invited to participate based on participation to previous EQAS iterations and/or affiliation to the EU network.

Participating laboratories represented all 28 EU Member States (MS) and four non-MS (Iceland, North Macedonia, Norway, and Switzerland; Appendix 2 and Figure 1). Only one set of data per MS is included in this report.

2.2 Strains

The eight enterococci, eight staphylococci and eight *E. coli* included in this EQAS were selected among the DTU-FOOD strain collection based on available MIC data. For quality assurance purposes, one strain per each bacterial species has been included in all

Figure 1. Countries colored in red participated to the EURL-AR EQAS on antimicrobial susceptibility testing of enterococci, staphylococci and/or *Escherichia coli*, 2018

EQAS iterations performed to date to represent an internal control.

Expected MIC values (Appendix 3) for this EQAS were generated by using Sensititre panels (Trek Diagnostic Systems) at DTU-FOOD and further verified by the U.S. FDA. Results could not be verified by FDA for: ampicillin and teicoplanin (enterococci); colistin, ertapenem, meropenem, temocillin, trimethoprim and tigecycline (*E. coli*); and cefoxitin, clindamycin, mupirocin, sulfamethoxazole, sulfamethoxazole-trimethoprim, tiamulin and trimethoprim (staphylococci). MICs were further determined at DTU-FOOD after production of agar stab cultures to confirm expected values prior to shipment and to ensure homogeneity of the test cultures.

Reference strains *Enterococcus faecalis* ATCC 29212, *Staphylococcus aureus* ATCC 29213 and *E. coli* ATCC 25922 were provided to new participants with instructions to store and maintain them for quality assurance purposes and future EQAS trials. The expected quality control ranges for the reference strains were retrieved from Clinical and Laboratory Standards Institute (CLSI) in documents M100-28th Ed. (2018) (App. 5).

2.3 Antimicrobials

The panels of antimicrobials recommended for AST in this trial are listed in Table 1.

These antimicrobials represent those defined by the Commission Implementing Decision 2013/652/EU for *E. coli* and enterococci, and those most recently recommended by EFSA for staphylococci.

Table 1. Panels of antimicrobials for antimicrobial susceptibility testing included in this EURL-AR EQAS 2018 component

Enterococci	Staphylococci	*Escherichia coli* 1st panel	*Escherichia coli* 2nd panel
Ampicillin, AMP	Cefoxitin, FOX	Ampicillin, AMP	Cefepime, FEP
Chloramphenicol, CHL	Chloramphenicol, CHL	Azithromycin, AZI	Cefotaxime + clavulanic acid (F/C)
Ciprofloxacin, CIP	Ciprofloxacin, CIP	Cefotaxime, FOT	Cefotaxime, FOT
Daptomycin, DAP	Clindamycin, CLN	Ceftazidime, TAZ	Cefoxitin, FOX
Erythromycin, ERY	Erythromycin, ERY	Chloramphenicol, CHL	Ceftazidime, TAZ
Gentamicin, GEN	Gentamicin, GEN	Ciprofloxacin, CIP	Ceftazidime+ clavulanic acid (T/C)
Linezolid, LZD	Linezolid, LZD	Colistin, COL	Ertapenem, ETP
Quinupristin-dalfopristin (Synercid), SYN	Mupirocin, MUP	Gentamicin, GEN	Imipenem, IMI
Teicoplanin, TEI	Quinupristin-dalfopristin (Synercid), SYN	Meropenem, MERO	Meropenem, MERO
Tetracycline, TET	Sulfamethoxazole, SMX	Nalidixic acid, NAL	Temocillin, TRM
Tigecycline, TGC	Sulfamethoxazole+Trimethoprim, SXT	Sulfamethoxazole, SMX	
Vancomycin, VAN	Tetracycline, TET	Tetracycline, TET	
	Tiamulin, TIA	Tigecycline, TGC	
	Trimethoprim, TMP	Trimethoprim, TMP	
	Vancomycin, VAN		

2.4 Distribution

The bacterial strains were dispatched as agar stab cultures on 31st May 2018. These bacterial cultures were shipped in double pack containers (class UN 6.2) as UN3373, biological substances category B according to the International Air Transport Association (IATA) regulations.

2.5 Procedure

The participants were recommended to keep the agar stab cultures refrigerated until performance of AST. Protocols and all relevant information were uploaded on the EURL-AR website (http://www.eurl-ar.eu) thus being available at any time (Appendix 4). Guidelines for performing AST were set according to the the ISO standard, ISO 20776-1 "Clinical laboratory testing and in vitro diagnostic test system – Susceptibility testing of infectious agents and evaluation of performance of antimicrobial susceptibility test devices".

Instructions for interpretation of AST results adhered to those specified in the Commission Implementing Decision 2013/652/EU, and were provided in the protocol (Appendix 4b: Tables 1, 2 and 3). Participants were invited to categorise the strains as resistant or susceptible using EUCAST epidemiological cut-off (ECOFF) values (www.eucast.org). For interpretation of the results of the *E. coli* 2nd panel (to be tested when a strain displayed resistance to cefotaxime, ceftazidime and/or meropenem in the *E. coli* 1st panel) participants were invited to adhere to recommendations by EFSA (Appendix 4b).

The EURL-AR is aware that there are two types of criteria for interpretation of MIC results: clinical breakpoints and ECOFF values. The terms 'susceptible', 'intermediate' and 'resistant' should be used for classification made in relation to the therapeutic application of

antimicrobial agents, whereas bacteria should be reported as 'wild-type' or 'non-wild-type' when reporting data relative to ECOFF values (Schwarz et al., 2010). To simplify the interpretation of results, we maintain the terms susceptible and resistant throughout this report even when referring to wild-type and non-wild-type strains, respectively.

All participants were invited to enter the obtained results into an electronic record sheet at the EURL-AR web-based database designed for this trial. Participants were also encouraged to complete an evaluation form available on the EURL-AR database with the aim to improve future EQAS trials.

The database could be accessed through a secured individual login and password.

The database was closed on 5th October 2018.

After this date, the participants were invited to login again to retrieve an individual database-generated evaluation report.

3. Results and Discussion

In this report, results from 28, 25 and 32 laboratories for enterococci, staphylococci and *E. coli* were evaluated, respectively. The participants were invited to report MIC values and categorisation as resistant or susceptible for each strain/antimicrobial combination. Only the categorisation was evaluated, whereas the MIC values were used as supplementary information.

3.1 Results excluded from the report

The following strain/antimicrobial combinations resulted in ≥ 25% deviations from expected results: ENT-12.3/CHL, ENT-12.5/DAP, ENT-12.6/CIP, ST-12.1/CIP, ST-12.2/SMX, ST-12.3/SYN, EC-12.6/IMI, EC-12.7/GEN and EC-12.7/IMI. In agreement with the decision by the EURL-AR network these results were carefully evaluated as reported below.

Table 2. Strain/antimicrobial combinations yielding ≥25% deviations from expected results excluded from the report

Strain/Antimicrobial	Expected MIC/int.[1]	Agree[2]	Disagree[3]
ENT-12.3/CHL	64/R	21	7
ENT-12.5/DAP[4]	8/R	4	18
ENT-12.6/CIP	4/S	8	20
ST-12.1/CIP[5]	1/S	10	14
ST-12.3/SYN[6]	1/S	4	18
EC-12.6/IMI[7]	2/R	7	11
EC-12.7/GEN	4/R	4[8]	28
EC-12.7/IMI[9]	0.5/S	14	16

CHL, chloramphenicol; CIP, ciprofloxacin; DAP, daptomycin; GEN, gentamicin; IMI, imipenem; SYN, quinupristin-dalfopristin.

[1]int., interpretation; [2]Number of labs with expected MIC and interpretation; [3]Number of labs with one-step dilution difference from expected MIC value (if not otherwise specified) leading to interpretation different from expected; [4]Six laboratories had > one-fold-dilution difference compared to expected MIC; [5]One laboratory had MIC one-fold dilution different from expected value leading to same interpretation as expected. [6]One laboratory did not upload any result for this strain/antimicrobial combination, one laboratory had MIC one-fold dilution different from expected value leading to same interpretation as expected.and another laboratory had > one-fold-dilution difference; [7]Three laboratories did not report MIC and/or interpretation and 11 laboratories had > one-fold-dilution difference compared to expected MIC; [8]One participant reported MIC=4 mg/L but interpreted it as S; [9]One laboratory did not report imipenem MIC and one laboratory reported MIC as expected (0.5 mg/L) but interpretation as R. Among the 16 laboratories in disagreement, eight had MIC=1 mg/L, which is one-step dilution above expected values and eight had MIC=0.25 mg/L, which is one-step dilution below expected value.

All results regarding the strain/antimicrobial combinations reported in Table 2 were excluded from the report as they mostly represented deviations caused by "one-fold dilution issues" that cannot be considered representative of the ability of the laboratories to perform AST.

For the strain/antimicrobial combination ST-12.2/SMX (sulfamethoxazole), it was noticed

that 21 (91%) of the 23 participants reporting SMX results for ST-12.2 obtained MIC ≤ 64 (n=18) or ≤ 128 (n=3) (leading to classification of the strain as SMX susceptible), which in both cases differed more than one-step dilution from the expected MIC > 512 (leading to classification of the strain as SMX resistant). Based on this, further investigations were made as follows. First of all, the EQAS preparation documents were retrieved and it was indeed noted that SMX MIC for this strain was unclear as there was growth in all SMX wells which however was smaller than the growth of the positive control. However, when deciding upon expected results, it was considered < 80% inhibition compared to the growth of the positive control. Furthermore, an analysis of whole genome sequence data was performed. The strain ST-12.2 had three mutations in the dihydropteroate synthase gene leading to amino acid changes T59S, V60L and F266L compared to the wild-type. The exact contribution of different mutations in the dihydropteroate synthase gene to sulfamethoxazole resistance in *S. aureus* has not been fully elucidated yet. However, these mutations usually appear in combination with additional mutations in sulfamethoxazole resistant strains thus they may not be sufficient to confer a resistance phenotype when present alone (Hampele et al., 1997; Yun et al., 2012). Based on the above, it was decided to revise the expected SMX MIC value for ST-12.2 as ≤ 64/S.

3.2 Overall performance

The percentage of results in agreement with those expected ranged from 96.3% (strain ST-12.5) to 100% (strain EC-12.1 and EC-12.5) (Table 3). The *E. coli* trial yielded the highest percentage of correct results (99.1%), tightly followed by the *S. aureus* trial (98.7%) and by the enterococci trial (98.2%).
The percentage of deviations from the expected results appears to be low (below 2%) and stable (Figure 2). The results for the internal *E. coli* and *S. aureus* control strains were the best ever obtained since the beginning of these EQAS components in 2008 (Figure 2). The results for the *Enterococcus* sp. reference strains were good with a fairly stable level of ca. 2% deviations since 2013. The list of deviations is reported in Appendices 8a, 8b and 8c.

Table 3. Total number (No.) and percentage (%) of antimicrobial susceptibility tests (AST) performed and in agreement with expected (correct) in the EURL-AR EQAS 2018

Strain	No. AST	No. correct	% correct	Strain	No. AST	No. correct	% correct	Strain	No. AST	No. correct	% correct
ENT-12.1	333	325	97,6	ST-12.1	406	405	99,8	EC-12.1	672	672	100
ENT-12.2	307	304	99,0	ST-12.2	431	427	99,1	EC-12.2	448	444	99,1
ENT-12.3	280	276	98,6	ST-12.3	407	403	99,0	EC-12.3	672	668	99,4
ENT-12.4	336	329	97,9	ST-12.4	431	426	98,8	EC-12.4	448	443	98,9
ENT-12.5	308	302	98,1	ST-12.5	429	413	96,3	EC-12.5	672	672	100
ENT-12.6	304	298	98,0	ST-12.6	430	424	98,6	EC-12.6	631	613	97,1
ENT-12.7	307	305	99,3	ST-12.7	431	426	98,8	EC-12.7	608	602	99,0
ENT-12.8	308	299	97,1	ST-12.8	431	428	99,3	EC-12.8	672	666	99,1

*ENT, enterococci; ST, *S. aureus* ; EC, *Escherichia coli*.

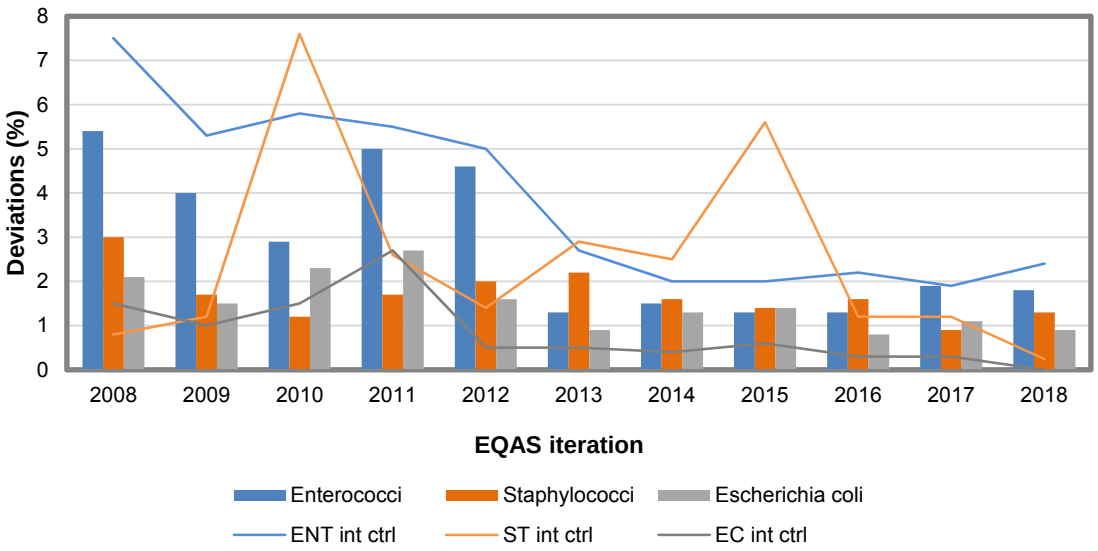

Figure 2. Overall deviations (%) from expected results by EQAS iteration. ENT, enterococci; ST, staphylococci; EC, *Escherichia coli*; int ctrl, internal control.

3.2.1 Enterococci

Twenty-eight laboratories (from 24 MS and four non-EU countries) approved results for the enterococci trial.

Strain-based analysis

Deviations ranged from 0.6% (n=2) for ENT-12.7 to 2.9% (n=9) for ENT-12.8 (Figure 3). For ENT-12.1, four (50%) out of eight deviations were “one-fold dilution issues” and the remaining indicated performance problems. For

ENT-12.2, ENT-12.3 and ENT-12.7, all (100%) three, four and two deviations, respectively, indicated performance problems. For ENT-12.4 and ENT-12.6, most deviations (57%, four out of seven and 67%, four out of six, respectively) were related to "one-fold dilution issues". Differently, for ENT-12.5 and ENT-12.8, most deviations (83%, five out of six and 78%, seven out of nine, respectively) indicated performance problems.

Antimicrobial-based analysis

No deviations from expected results were obtained when testing susceptibility to ciprofloxacin, gentamicin and tetracycline (Figure 4). The antimicrobials that resulted in highest percentages of deviations were tigecycline (10.4%), quinupristin-dalfopristin (4.6%), and chloramphenicol and daptomycin (1.5% each). All (n=23) deviations obtained out of 224 reported results for tigecycline indicated performance issues. Tigecycline is sensitive to light and temperature, and degradation of the antimicrobial has been described to happen frequently if panels are not handled properly (please refer also to the presentation by Dr. Michel Rapallini at the EURL-AR workshop 2016 https://www.eurl-ar.eu/CustomerData/Files/Folders/20-reports-earl-ar-workshop/273_eurl-ar-ws2016-minutes-final.pdf). Furthermore, tigecycline MIC reading might be difficult due to occurrence of tiny pellets of dubious interpretation (trailing growth).

Laboratories that obtained deviations are invited to consult the CLSI document M07-Ed.11th for detailed guidelines on MIC reading when trailing occurs and to ensure that procedures for handling panels containing tigecycline are correct. Furthermore, laboratories are welcome to contact the EURL-AR if further clarifications are needed. For quinupristin-dalfopristin, chloramphenicol and daptomycin, all deviations (four out of 109 reported values, 3/196 and 3/196, respectively) were "one-fold dilution issues" thus simply a consequence of the limitation in reproducibility of the MIC method.

An overview of obtained and expected results is reported in Appendix 7a.

Laboratory-based analysis

Eleven laboratories (39%) reported all results in agreement with those expected (Figure 5). Furthermore, all deviations from seven additional laboratories were "one-fold dilution issues" thus indicating that 64% of the laboratories participating to this EQAS component had no technical performance issues (Figure 5).

Lab # 26, 39 and 45 had one deviation each. Lab # 26 and 45 reported incorrect tigecycline MIC, which might be related to the above mentioned challenges in testing MIC for this antimicrobial, whereas Lab # 39 reported an incorrect teicoplanin MIC.

Lab # 11, 20 and 22 had three deviations each. For Lab # 11 and 20 the deviations could indicate issues in erythromycin and tigecycline MIC testing, respectively. For Lab # 22, most deviations were one-fold dilution issues", thus not related to technical performance issues.

Lab # 17 had four deviations that could indicate issues in tigecycline MIC testing.

Finally, three laboratories had percentages of deviations above the threshold for acceptable laboratory performance, which is set at 5 % (Figure 5).

Lab # 41 and 61 had six deviations each, which mostly indicated challenges in tigecycline MIC testing. Lab # 34 had nine deviations, seven of which indicated challenges in tigecycline MIC testing whereas the remaining were "one-step dilution issues".

Deviations from expected results obtained by each participant in the enterococci trial are

reported in Appendix 8a.

Enterococci species identification

Participants were requested to identify the enterococci species as a mandatory component. The test strains were four *E. faecium* (ENT-12.1, ENT-12.4, ENT-12.5 and ENT-12.6) and four *E. faecalis* (ENT-12.2, ENT-12.3, ENT-12.7 and ENT-12.8). Enterococci species identification results were uploaded by all participants for a total of 224 results that were all (100%) in agreement what those expected, indicating excellent performance in this EQAS component.

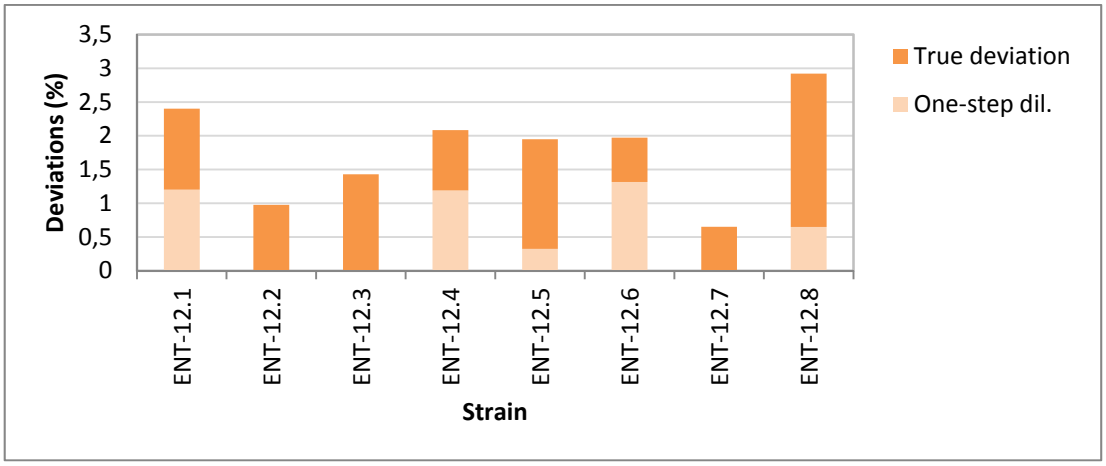

Figure 3. Deviations (%) from expected interpretation of AST result for each *Enterococcus* sp. strain, EURL-AR EQAS 2018. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

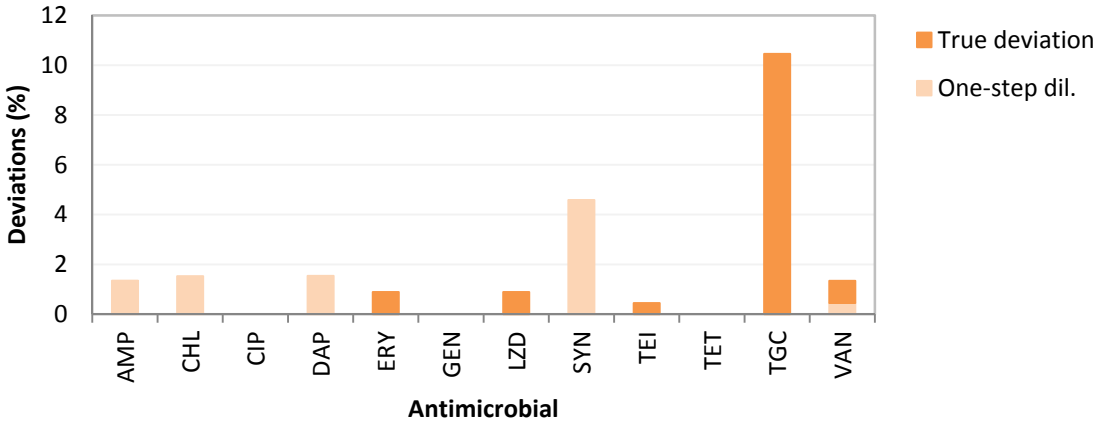

Figure 4. Deviations (%) from expected interpretation of AST results for each antimicrobial. Enterococci component of the EURL-AR EQAS 2018. AMP, ampicillin; CHL, chloramphenicol; CIP, ciprofloxacin; DAP, daptomycin; ERY, erythromycin; GEN, gentamicin; LZD, linezolid; SYN, quinupristin/dalfopristin (synercid); TEI, teicoplanin; TET, tetracycline; TGC, tigecycline; VAN, vancomycin. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

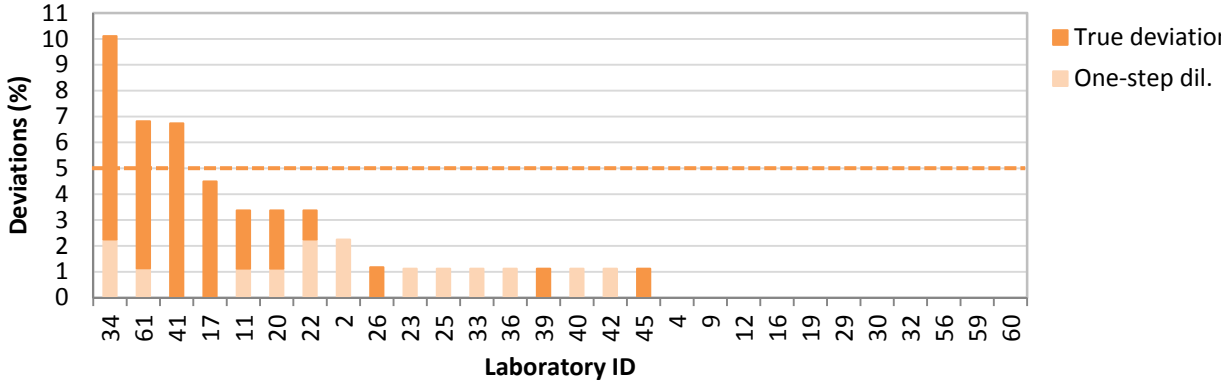

Figure 5. Deviations (%) by participating laboratory in the enterococci trial, EURL-AR EQAS 2018. The dashed line indicates the threshold (5%) for acceptable laboratory performance. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

3.2.2 Staphylococci

Twenty-five laboratories (from 22 MS and three non-MS) uploaded results for the staphylococci trial.

Strain-based analysis

Deviations ranged from 0.2% (n=1) in ST-12.1 to 3.7% (n=16) in ST-12.5 (Figure 6). In ST-12.7, most (60%, n=3) deviations were "one-fold dilution issues". In ST-12.5, half (50%, n=1 and n=8, respectively) of the observed deviations were "one-fold dilution issues", whereas the remaining could indicate performance issues. In ST-12.2, ST-12.3, ST-12.4 and ST12.8, most deviations (75%, n=3; 75%, n=3; 60%, n=3; and 67%, n=2, respectively) could indicate performance issues. Finally, all (100%) deviations observed for ST12.1 and ST-12.6 (n=1 and n=6, respectively) could indicate performance issues.

Antimicrobial-based analysis

All (100%) results for linezolid, rifampicin, streptomycin and vancomycin were in agreement with those expected (Figure 7).

The antimicrobials that resulted in highest percentages of deviations were sulfamethoxazole (4.8%), quinupristin-dalfopristin (2.9%), cefoxitin (2.6%) and clindamycin (2.5%) (Figure 7). For sulfamethoxazole, all (100%) nine deviations indicated performance issues. Sulfamethoxazole MIC reading is challenging as MIC has to be read at the concentration in which there is ≥ 80% reduction in growth compared to the positive control, which may lead to subjective interpretations.

For quinupristin-dalfopristin, all (100%) five deviations represented "one-fold dilution issues", thus indicating no technical performance problems in testing *S. aureus* susceptibility to this antimicrobial.

For cefoxitin, most (60%, three out of five) deviations indicated possible performance issues. Despite this, it is interesting to notice that all laboratories performed correct identification of methicillin-resistant and methicillin-susceptible *S. aureus* (MRSA and MSSA, respectively; explained further below in the report), which suggests that at least some laboratories used methods other than cefoxitin MIC determination to establish if strains are MRSA or MSSA.

Also for clindamycin, most (60%, three out of five) deviations indicated possible performance issues. Clindamycin MIC reading may be challenging due to trailing growth. Detailed guidelines on clindamycin MIC reading are reported in the CLSI document M07-Ed.11th.

An overview of obtained and expected results is reported in Appendix 7b.

Laboratory-based analysis

Eleven laboratories (44%) reported all results in agreement with those expected (Figure 8). Furthermore, all deviations from five additional laboratories were "one-fold dilution issues" thus indicating that 64% of the laboratories participating to this EQAS component had no technical performance issues (Figure 8).

Lab # 11, 12 and 36 had one deviation each, respectively, caused by incorrect sulfamethoxazole MIC. As explained above, sulfamethoxazole MIC reading is challenging as MIC has to be read at the concentration in which there is ≥ 80% reduction in growth compared to the positive control, which is prone to subjective interpretations.

Lab # 17, 40 and 56 had four deviations each. For Lab # 17 and 56, only half (50%) of the deviations were considered "true deviations" and might indicate problems in clindamycin and

erythromycin MIC determination for ST-12.5 for both laboratories. For Lab # 40, most (75%) deviations could indicate problems in fusidic acid and sulfamethoxazole MIC determination.

Lab # 34 and 45 had six deviations each. In each laboratory, all but one deviation might indicate performance issues either in sulfamethoxazole MIC reading for Lab # 45 or with various strain/antimicrobial combinations for Lab # 34.

Finally, Lab # 39 had 10% deviations, which is above the threshold for acceptable laboratory performance (5 %) (Figure 8). True deviations were observed for four strains and for six antimicrobials, thus indicating a general issue rather than problems in defining MIC for specific challenging antimicrobials.

Deviations from expected results obtained by each participant in the staphylococci trial are reported in Appendix 8b.

Methicillin-resistant *S. aureus*

Participants were requested to identify the presence/absence of methicillin resistance as a mandatory component. The test strains included three methicillin-resistant *S. aureus* (MRSA; ST-12.1, ST-12.3 and ST-12.8) and five methicillin-susceptible *S. aureus* (MSSA; ST-12.2, ST-12.4, ST-12.5, ST-12.6 and ST-12.7). All participants submitted MRSA/MSSA results. All 200 results were in agreement with those expected.

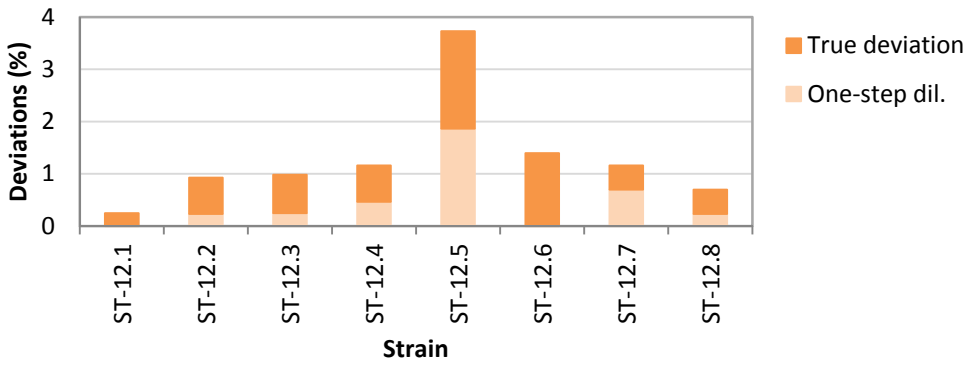

Figure 6. Deviations (%) from expected interpretation of AST results for each *Staphylococcus aureus* strain, EURL-AR EQAS 2018. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

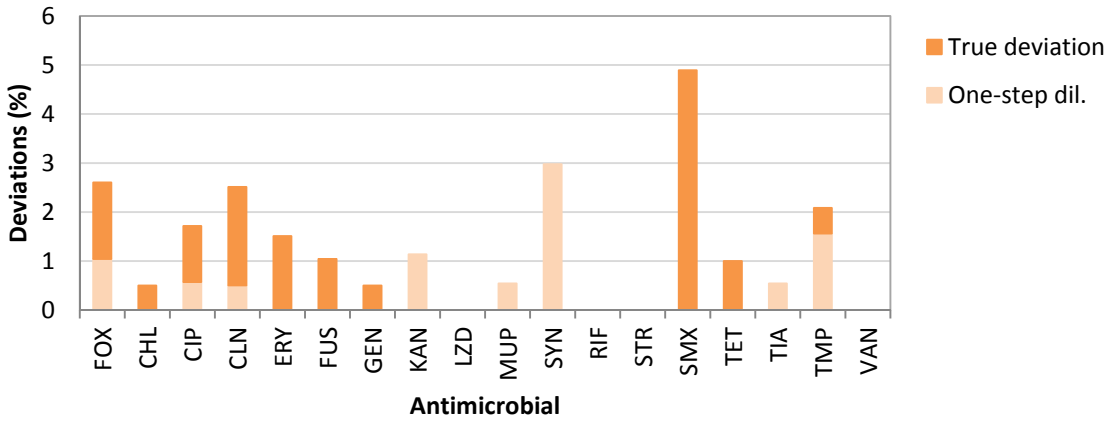

Figure 7. Deviations (%) from expected interpretation of AST results for each antimicrobial. *Staphylococcus aureus* component of the EURL-AR EQAS 2018. FOX, cefoxitin; CHL, chloramphenicol; CIP, ciprofloxacin; CLN, clindamycin; ERY, erythromycin; FUS, fusidic acid; GEN, gentamicin; KAN, kanamycin; LZD, linezolid; MUP, mupirocin; SYN, quinupristin/dalfopristin (synercid); RIF, rifampicin; SMX, sulfamethoxazole; TET, tetracycline; TIA, tiamulin; TMP, trimethoprim; VAN, vancomycin. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

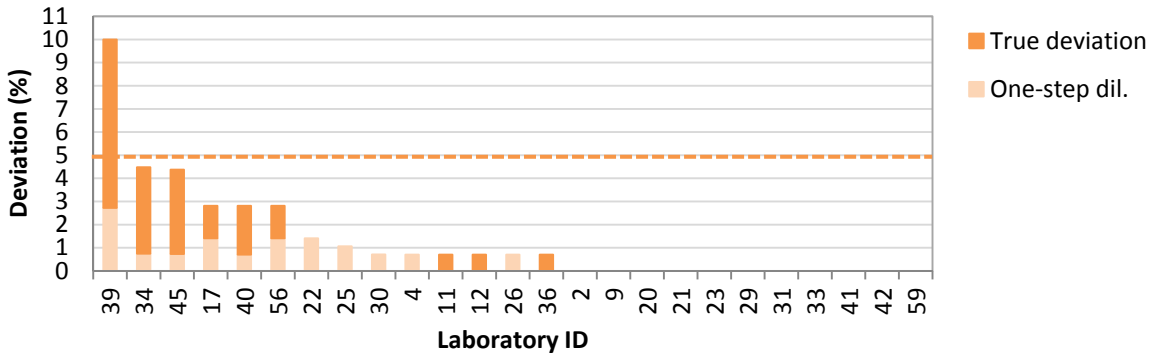

Figure 8. Deviations (%) by participating laboratory in the staphylococci trial, EURL-AR EQAS 2018. The dotted line indicates the threshold for acceptable laboratory performance. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

3.2.3 *Escherichia coli*

Thirty-two laboratories (from 28 MS and four non-MS) uploaded results for the *E. coli* trial.

Strain-based analysis

Deviations ranged from 0% for EC-12.1 and EC-12.5 to 2.8% (n=18) for EC-12.6 (Figure 9). For EC-12.2, all four deviations indicated performance problem. For EC-12.3, two out of four (50%) deviations were "one-fold dilution issues" and the remaining could indicate performance problems. For EC-12.4, three (60%), out of five deviations were "one-fold dilution issues" and the remaining could indicate performance problems. For EC-12.6, eleven (61%) out of 18 deviations were "one-fold dilution issues" (n=10) or different interpretation of MIC value obtained as expected (n=1), and the remaining deviations could indicate performance problems. For EC-12.7, three (50%) of six deviations were "one-fold dilution issues" and the remaining deviations indicated performance problems. For EC-12.8, five (83%) out of six deviations were "one-fold dilution issues" and the remaining deviation indicated a performance problem.

Antimicrobial-based analysis

No deviations from expected results were obtained when testing susceptibility to ampicillin, cefepime, gentamicin, imipenem, tetracycline and trimethoprim (Figure 10). The antimicrobials that resulted in highest percentages of deviations were cefoxitin (4.2%), meropenem (2.2%), and azithromycin, colisitin and tigecycline (1.5% deviations each) (Figure 10). For cefoxitin, eight deviations were observed out of 190 uploaded results, and all deviations were "one-fold dilution issues". For meropenem, ten deviations were observed out of 447 uploaded results. Three (30%) of such deviations were "one-fold dilution issues" whereas the remaining 70% could indicate performance issues. For azithromycin, four deviations were observed out of 256 uploaded results and most (n=3; 75%) of these deviations were "one-fold dilution issues". For colistin, all (n=4, 100%) observed deviations out of 254 uploaded results were "one-fold dilution issues". For tigecycline, four deviations were observed out of 256 uploaded results and half (n=2; 50%) of these deviations were "one-fold dilution issues", whereas the remaining deviations could indicate performance issues.

An overview of obtained and expected results is reported in Appendix 7c.

Laboratory-based analysis

All laboratories (100%) performed within the threshold for acceptable laboratory performance (≤5%), which represents an extremely positive outcome of the *E. coli* component of the EURL-AR EQAS 2018.

Eighteen laboratories (56.2%) reported all results in agreement with those expected and (Figure 11).

Four laboratories (12.5%) had 0.6% deviation each representing one deviation per laboratory. These deviations were "one-fold dilution issues" (n=3) or different interpretation of MIC value obtained as expected (n=1, likely indicating an inaccuracy when uploading results to the database), thus no technical performance issues were identified also for Lab # 18, 36, 39 and 42.

Two laboratories (6.3%) had 1.3% deviations, corresponding to two deviations each. In one case (Lab # 6), both deviations were "one-fold dilution issues", so also for this laboratory there were no performance issues. In the second case (Lab # 23), one deviation was a "one-fold dilution issue", and the remaining one could indicate a performance issue.

Two laboratories (6.3%) had 1.9% deviations, corresponding to three deviations each. In one case (Lab # 22), two deviations were "one-fold

dilution issues" (n=2) or different interpretation of MIC value obtained as expected (n=1, likely indicating an inaccuracy when uploading results to the database), thus also for this laboratory there were no technical performance issues. In the second case (Lab # 40), one deviation was a "one-fold dilution issue", and the remaining two represented true deviations which could indicate a performance issue.

Three laboratories (9.3%) had 2.6% deviations corresponding to four deviations each. In Lab # 4, 33 and 45, 25% (n=1), 50% (n=2) and 100% (n=4) of deviations were "one-fold dilution issues", respectively, whereas the remaining deviations might indicate a performance issue.

Two laboratories (6.3%) had 3.3% deviations corresponding to five deviations each. In Lab # 11 and 26, 40% (n=2) and 20% (n=1) of deviations were "one-fold dilution issues", respectively, whereas the remaining deviations might indicate a performance issue.

Finally one laboratory (3.1%; Lab # 61) had 4.8% deviations corresponding to seven results deviating from those expected. Three of these deviations (43%) were "one-fold dilution issues", whereas the remaining deviations might indicate a performance issue.

Deviations from expected results obtained by each participant in the *E. coli* trial are reported in Appendix 8c.

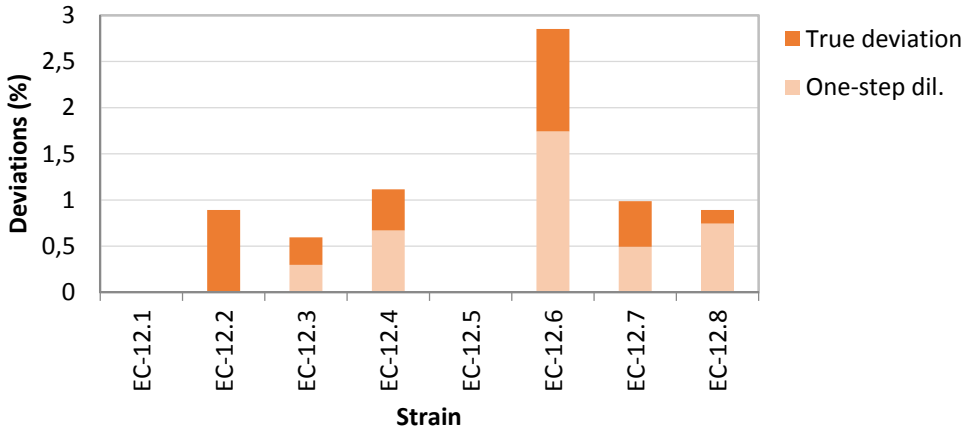

Figure 9. Deviations (%) from expected interpretation of AST results for each *Escherichia coli* strain, EURL-AR EQAS 2018. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

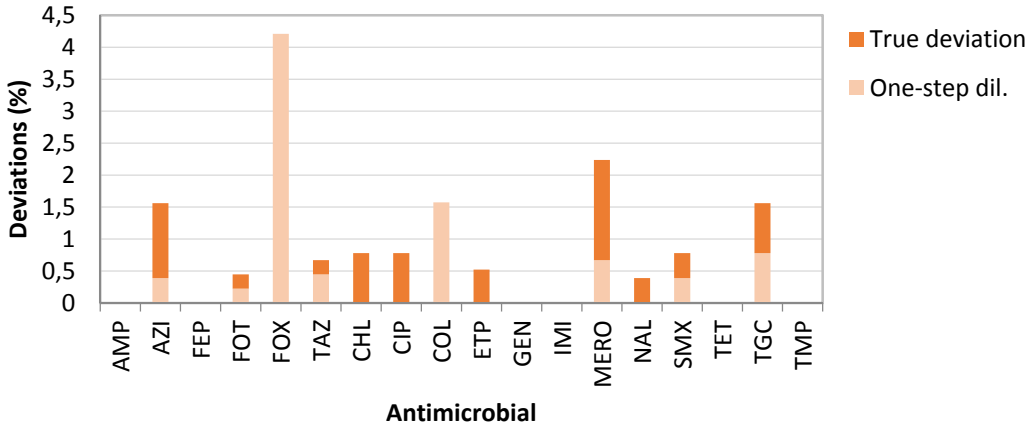

Figure 10. Deviations (%) from expected interpretation of AST results for each antimicrobial. *Escherichia coli* component of the EURL-AR EQAS 2018. AMP, ampicillin; AZI, azithromycin; FEP, cefepime; FOT, cefotaxime; TAZ, ceftazidime; CHL, chloramphenicol; CIP, ciprofloxacin; COL, colistin; ETP, ertapenem; GEN, gentamicin; IMI, imipenem; MERO, meropenem; NAL, nalidixic acid; SMX, sulfamethoxazole; TET, tetracycline; TGC, tigecycline; TMP, trimethoprim. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

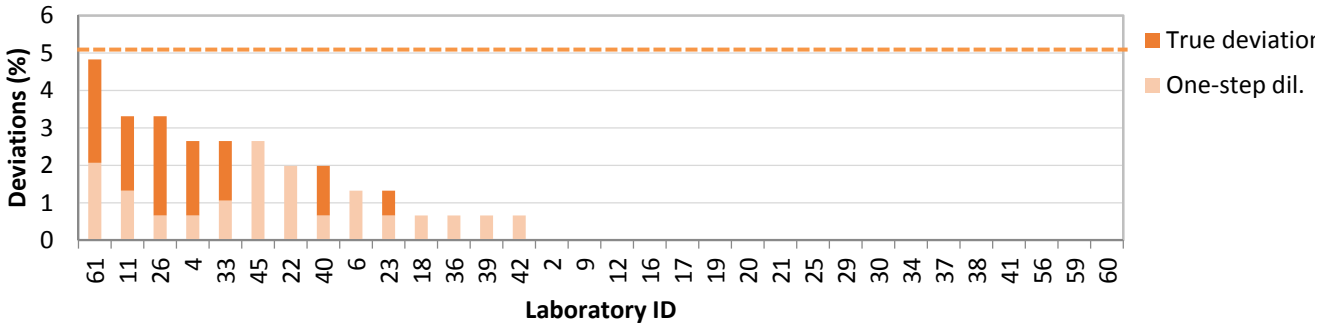

Figure 11. Deviations (%) by participating laboratory in the *Escherichia coli* trial, EURL-AR EQAS 2018. The dashed line indicates the threshold (5%) for acceptable laboratory performance. "True deviation" could indicate a technical performance issue, whereas "one-step dilution" represents a limitation in reproducibility of the MIC method and not a technical performance issue (see text for further details). Sporadic cases of erroneous interpretation of MIC values obtained as expected are included among "one-step dil.".

Beta-lactamase-producing *E. coli*

Participants were requested to detect the production of beta-lactamases and classify the beta-lactam resistance phenotype into Extended-Spectrum Beta-Lactamase (ESBL)/AmpC/carbapenemase production as a mandatory component.

Guidelines for interpretation of the beta-lactam resistance phenotype were specified in the protocol (Appendix 4b) and were in agreement with the latest recommendations by EFSA.

In this EQAS, EC-12.1, EC-12.3 and EC-12.8 were ESBL producers, and EC-12.5, EC-12.6 and EC-12.7 were carbapenemase producers. The remaining strains (EC-12.2 and EC-12.4) did not produce any beta-lactamase mediating ESBL/AmpC/carbapenemase phenotype.

All 32 participants uploaded results for this part of the *E. coli* trial. The vast majority of laboratories (≥ 87.5%) performed correct detection and classification of the test strains (Table 4). However, twelve cases of misclassification (Table 4) were observed in nine laboratories indicating some difficulties in classification of beta-lactam resistance phenotypes.

Strain code		EC-12.1	EC-12.2	EC-12.3	EC-12.4	EC-12.5	EC-12.6	EC-12.7	EC-12.8
Expected results		ESBL	Suscept.	ESBL	Suscept.	Carbapenemase	Carbapenemase	Carbapenemase	ESBL
Obtained results	ESBL	32/32 (100%)		30/32 (93.8%)				1/32 (3.1%)	30/32 (93.8%)
	AmpC								
	ESBL + AmpC			2/32 (6.2%)				1/32 (3.1%)	2/32 (6.2%)
	Carbapenemase				1/32 (3.1%)	32/32 (100%)	28/32 (87.5%)	30/32 (93.8%)	
	Other		1/32 (3.1%)				4/32 (12.5%)		
	Susceptible		31/32 (96.9%)		31/32 (96.9%)				
Genetic background		*bla*$_{CTX-M-1}$	no beta-lactam resistance gene detected	*bla*$_{CTX-M-55}$	no beta-lactam resistance gene detected	*bla*$_{VIM-1}$	*bla*$_{OXA-162}$	*bla*$_{GES-5}$	*bla*$_{CTX-M-15}$

Table 4. Expected and obtained classification of beta-lactam resistance phenotype and genetic background of each *Escherichia coli* strain, EURL-AR EQAS 2018.

3.3 Performance in AST of the quality control strains

Antimicrobial susceptibility test results for the quality control strains were evaluated based on the CLSI quality control ranges (Appendix 5).

3.3.1 *Enterococcus faecalis* ATCC 29212

All 28 participants in the enterococci trial performed AST of *E. faecalis* ATCC 29212 by MIC determination reporting a total of 308 test results, of which 98.7% were within the acceptable range (Table 5). Four laboratories obtained tigecycline MIC one-step dilution above the acceptable range.

Table 5. Antimicrobial susceptibility testing of *Enterococcus faecalis* ATCC 29212 by MIC determination

Antimicrobial	Proportion outside of range	Below acceptable range	Above acceptable range
Ampicillin	0/28 (0%)	–	–
Chloramphenicol	0/28 (0%)	–	–
Ciprofloxacin	0/28 (0%)	–	–
Daptomycin	0/28 (0%)	–	–
Erythromycin	0/28 (0%)	–	–
Gentamicin	0/28 (0%)	–	–
Linezolid	0/28 (0%)	–	–
Quinu/dalfopristin	-	–	–
Teicoplanin	0/28 (0%)	–	–
Tetracycline	0/28 (0%)	–	–
Tigecycline	4/24 (16%)	–	4
Vancomycin	0/28 (0%)	–	–

3.3.2 *Staphylococcus aureus* ATCC 29213

All 25 participants in the staphylococci trial performed AST of *S. aureus* ATCC 29213 by MIC determination reporting a total of 397 test results, of which 98.2% were within the acceptable range (Table 6). The deviation for ciprofloxacin was obtained by Lab #36 reporting a MIC one-fold dilution above the highest value of the acceptable range. The deviations for penicillin were obtained by Lab # 22, 30, 41 and 42 reporting a MIC one-fold dilution below the lowest value of the acceptable range, and by Lab # 31 and 36 reporting a MIC higher than one-fold dilution above the highest value of the acceptable range.

Table 6. Antimicrobial susceptibility testing of *Staphylococcus aureus* ATCC 29213 by MIC determination

Antimicrobial	Proportion outside of range	Below acceptable range	Above acceptable range
Cefoxitin	0/24 (0%)	–	–
Chloramphenicol	0/25 (0%)	–	–
Ciprofloxacin	1/25 (4%)	–	1
Clindamycin	0/25 (0%)	–	–
Erythromycin	0/25 (0%)	–	–
Fusidic acid	0/20 (0%)	–	–
Gentamicin	0/25 (0%)	–	–
Kanamycin	0/19 (0%)	–	–
Linezolid	0/25 (0%)	–	–
Penicillin	6/20 (40%)	4	2
Quinu/dalfopristin	0/24 (0%)	–	–
Rifampicin	0/20 (0%)	–	–
Sulfamethoxazole	0/23 (0%)	–	–
Sulfa/Trimethoprim	0/4 (0%)	–	–
Tetracycline	0/25 (0%)	–	–
Trimethoprim	0/24 (0%)	–	–
Vancomycin	0/24 (0%)	–	–

3.3.3 *Escherichia coli* ATCC 25922

A total of 31 out of 32 participants in the *E. coli* trial tested *E. coli* ATCC 25922 by MIC determination reporting a total of 598 test results, of which 98.8% were within the acceptable range (Table 7). The deviations for trimethoprim were obtained by different laboratories (Lab # 18, 23 and 26) and the remaining deviations were obtained by Lab #60. This laboratory realised to have performed typing mistakes when typing data into the database and informed the EQAS organizer that obtained results were indeed in range.

Further details on test results of quality control strains are reported in Appendix 6.

Table 7. Antimicrobial susceptibility testing of *Escherichia coli* ATCC 25922 by MIC determination.

Antimicrobial	Proportion outside of range	Below accept. range	Above accept. range
Ampicillin	1/31 (3.2%)	1	–
Azithromycin	no range	–	–
Cefotaxime	0/58 (0%)	–	–
Ceftazidime	0/59 (0%)	–	–
Chloramphenicol	0/31 (0%)	–	–
Ciprofloxacin	0/31 (0%)	–	–
Colistin	0/31 (0%)	–	–
Gentamicin	0/31 (0%)	–	–
Meropenem	0/59 (0%)	–	–
Nalidixic acid	0/31 (0%)	–	–
Sulfamethoxazole	1/31 (3.2%)	1	–
Tetracycline	1/31 (3.2%)	1	–
Tigecycline	1/31 (3.2%)	–	1
Trimethoprim	3/31 (9.6%)	3	–
Cefepime	0/28 (0%)	–	–
Cefotaxime/clavulanic acid	no range	–	–
Cefoxitin	0/28 (0%)	–	–
Ceftazidime/clavulanic acid	no range	–	–
Ertapenem	0/28 (0%)	–	–
Imipenem	0/28 (0%)	–	–
Temocillin	no range	–	–

4. Conclusions

This report presented the result of the EURL-AR EQAS 2018 for *E. coli*, enterococci and staphylococci. This proficiency test evaluated the performance in i) MIC determination and interpretation, ii) enterococci species identification and iii) detection of relevant phenotypes such as methicillin resistance in *S. aureus* and beta-lactam resistance mediated by ESBL/AmpC/carbapenemase in *E. coli*.

Participants invited to this EQAS represent NRL-AR from each EU MS and additional laboratories affiliated to the EURL-AR network including laboratories from non-MS and laboratories other than NRL-AR in MS.

Results from NRL-AR and from one laboratory per non-MS were analysed in this report, leading to a total of 28 (24 MS and 4 non-MS), 25 (22 MS and 3 non-MS) and 32 (28 MS and 4 non-MS) sets of results analysed for enterococci, staphylococci and *E. coli*, respectively.

In the MIC determination and interpretation component, three, one and no laboratories obtained more than 5% deviations in the enterococci, staphylococci and *E. coli* trial, respectively. Communication between the EURL-AR and these underperforming laboratories is ongoing to assess the causes of the high percentages of deviations and to identify possible troubleshooting procedures.

Generally, a notable proportion of deviations was caused by expected MIC values close to breakpoint for resistance. Thus, a one-fold dilution difference from expected value, which is a limitation of MIC determination method reproducibility, resulted in different interpretation and was scored as a deviation. This is not indicative of any performance problem. However, it was also possible to identify a few performance issues that could be addressed in a relatively easy way by the involved laboratories such as deviations due to different interpretation of MIC values that were obtained in agreement with those expected. Notable deviations were those obtained in tigecycline and sulfamethoxazole susceptibility testing in enterococci and *S. aureus,* respectively. Testing of these antimicrobials may be challenging due to lability of the compound (in case of tigecycline) and specific MIC reading rules that may be very operator-dependent (in case of sulfamethoxazole). Laboratories having issues in detecting these phenotypes are invited to contact the EURL-AR that will provide assistance for troubleshooting.

Enterococci species identification was performed correctly by all laboratories indicating excellent performance in this EQAS component.

Also detection of methicillin resistance in *S. aureus* was correctly performed by all laboratories even though cefoxitin MIC determination yielded a few deviations. This suggests that at least some laboratories rely on methods other than cefoxitin MIC testing for MRSA/MSSA status determination.

Detection of ESBL/AmpC/carbapenemase production in *E. coli* was correctly performed by the vast majority of laboratories. Interpretation of the beta-lactam resistance phenotypes presented challenges for a few laboratories highlighting the need to further support the network in classification of the beta-lactam resistance phenotypes according to the EFSA guidelines.

Overall, performance in this EQAS was consistent with that observed in EQAS iterations since 2014 both regarding total percentage of deviations and number of laboratories with percentage of deviations

above the acceptable limit. This implies that further efforts should be made to ensure excellent AST performance across all laboratories in the network.

As usual, the EURL-AR welcomes suggestions for improvement of future EQAS trials and invites the network to contribute with ideas for newsletters and for training needs, with the overall goal to continuously improve the knowledge and skills of the laboratories involved in the AMR monitoring.

5. References

European Food Safety Authority; Technical specifications on the harmonised monitoring and reporting of antimicrobial resistance in methicillin-resistant *Staphylococcus aureus* in food-producing animals and food. EFSA Journal 2012; 10(10):2897. [56 pp.] doi:10.2903/j.efsa.2012.2897. Available online: www.efsa.europa.eu/efsajournal

European Commission, 2013/652/EU: Commission Implementing Decision of 12 November 2013 on the monitoring and reporting of antimicrobial resistance in zoonotic and commensal bacteria

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EU Reference Laboratory for Antimicrobial Resistance
External Quality Assurance System (EQAS) 2018

DTU Food
National Food Institute

G00-06-001/23.06.2017

EQAS 2018 FOR *E. COLI*, STAPHYLOCOCCI AND ENTEROCOCCI

The EURL-AR announces the launch of another EQAS, thus providing the opportunity for proficiency testing which is considered an essential tool for the generation of reliable laboratory results of consistently good quality.

This EQAS consists of antimicrobial susceptibility testing of eight *E. coli* isolates, eight staphylococci and eight enterococci isolates. Additionally, quality control (QC) strains *E. coli* ATCC 25922 (CCM 3954), *E. faecalis* ATCC 29212 (CCM 4224), and *S. aureus* ATCC 29213 (CCM 4223) will be distributed to new participants.

It is the recipients' responsibility to comply with national legislation, rules and regulation regarding the correct use and handling of the provided strains and to possess the proper equipment and protocols to handle these strains.

This EQAS is specifically for NRL's on antimicrobial resistance (NRL-AR). Laboratories designated to be NRL-AR do not need to sign up to participate but are automatically regarded as participants. You may contact the EQAS-Coordinator if you wish to inform of changes in relation to your level of participation in compared to previous years. The EURL-AR will be able to cover the expenses for one parcel, only, per EU Member State. Therefore, countries with more than one laboratory registered on the EURL-AR contact-list will be contacted directly to confirm which laboratory will be included for participation free of charge.
The invitation to participate in the proficiency test is extended to additional participants besides official NRLs and to participants from laboratories which are involved in the network but are not designated NRLs (cost for participation will be 100 euro).

TO AVOID DELAY IN SHIPPING THE ISOLATES TO YOUR LABORATORY

The content of the parcel is "UN3373, Biological Substance Category B": Eight *E. coli*, eight staphylococci, eight enterococci and for new participants also the QC strains mentioned above. Please provide the EQAS coordinator with documents or other information that can simplify customs procedures (e.g. specific text that should be written on the proforma invoice). To avoid delays, we kindly ask you to send this information already at this stage.

TIMELINE FOR RESULTS TO BE RETURNED TO THE NATIONAL FOOD INSTITUTE

Shipment of isolates and protocol: The isolates will be shipped at the **end of May 2018**. The protocol for this proficiency test will be available for download from the website (www.eurl-ar.eu).
Submission of results: Results must be submitted to the National Food Institute **no later than September 14th, 2018** via the password-protected website.
Upon reaching the deadline, each participating laboratory is kindly asked to enter the password-protected website once again to download an automatically generated evaluation report.
EQAS report: A report summarising and comparing results from all participants will be issued. To comply with current EU legislation (2013/652/EU), only MIC results obtained by broth microdilution will be evaluated in the report. In the report, laboratories will be presented coded, which ensures full anonymity. The EURL-AR and the EU Commission, only, will have access to un-coded results. The report will be publicly available.
Next EQAS: The next EURL-AR EQAS that we will launch are isolation of ESBL-/AmpC-producing *E. coli* from caeca and meat samples in September 2018 and antimicrobial susceptibility testing of *Salmonella* and *Campylobacter* in October 2018.

Please contact me if you have comments or questions regarding the EQAS.

Sincerely,
Susanne Karlsmose Pedersen
EURL-AR EQAS Coordinator

Participants in the EURL-AR EQAS on *E. coli*, enterococci and staphylococci 2018

Institute	Country	*E. coli*	Enterococci	*S. aureus*
Austrian Agency for Health and Food Safety	Austria	x	x	x
Sciensano	Belgium	x	x	x
National Diagnostic and Research Veterinary Institute	Bulgaria	x	x	x
Croatian Veterinary Institute	Croatia	x	x	x
Veterinary Services	Cyprus	x	no	no
State Veterinary Institute Praha	Czech Republic	x	x	x
National Food Institute	Denmark	x	x	x
Danish Veterinary and Food Administration, DVFA	Denmark	x	x	no
Estonian Veterinary and Food Laboratory	Estonia	x	x	x
Finnish Food Safety Authority EVIRA	Finland	x	x	x
Agence nationale de sécurité sanitaire ANSES - Laboratoire de Fougères	France	x	x	no
Federal Institute for Risk Assessment	Germany	x	x	x
Veterinary Laboratory of Chalkis	Greece	x	no	no
Central Agricultural Office Veterinary Diagnostic Directorate	Hungary	x	x	no
University of Iceland	Iceland	x	x	x
Central Veterinary Research Laboratory	Ireland	x	x	x
Istituto Zooprofilattico Sperimentale delle Regioni Lazio e Toscana	Italy	x	no	x
Institute of Food Safety, Animal Health and Enviroment "BIOR"	Latvia	x	x	x
National Food and Veterinary Risk Assessment Institute	Lithuania	x	x	x
Laboratoire National de Santé	Luxembourg	x	x	x
Faculty of Veterinary Medicine - Skopje	North Macedonia	x	x	no
Public Health Laboratory	Malta	x	x	x
Food and Consumer Product Safety Authority (VWA)	Netherlands	x	x	x
Central Veterinary Institute of Wageningen UR	Netherlands	x	x	x
Veterinærinstituttet	Norway	x	x	x
National Veterinary Research Institute	Poland	x	x	x
Instituto Nacional de Investigação Agrária e Veterinária	Portugal	x	no	no
Institute for Hygiene and Veterinary Public Health	Romania	x	x	x
Institute for Diagnosis and Animal Health	Romania	x	x	x
State Veterinary and Food Institute (SVFI)	Slovakia	x	x	x
National Veterinary Institute	Slovenia	x	x	x
Laboratorio Central de Sanidad, Animal de Santa Fe	Spain	no	no	x
Laboratorio Central de Sanidad, Animal de Algete	Spain	no	x	no
VISAVET Health Surveillance Center, Complutense University	Spain	x	x	x
Centro Nacional de Alimentación (AECOSAN)	Spain	x	no	no
National Veterinary Institute, SVA	Sweden	x	x	x
Vetsuisse faculty Bern, Institute of veterinary bacteriology	Switzerland	x	x	x
The Veterinary Laboratory Agency	United Kingdom	x	x	x

Color code
NRLs_results evaluated in the report
non-NRL enrolled for EQAS or extra-NRL enrolled_results not evaluated in the report
NRL from non EU MS_results evaluated in the report

Expected MIC values

Strain ID	Species	Antimicrobial											
		DAP	TIG	TEI	AMP	CHL	CIP	ERY	GEN	LZD	Q-D	TET	VAN
EURL ENT 12.1	*Enterococcus faecium*	1	0.12	64	4	<=4	0.5	2	<=8	2	4	64	>128
EURL ENT 12.2	*Enterococcus faecalis*	4	0.12	<=0.5	1	8	1	<=1	16	2	8	<=1	2
EURL ENT 12.3	*Enterococcus faecalis*	2	0.12	<=0.5	1	64	1	>128	16	8	16	128	2
EURL ENT 12.4	*Enterococcus faecium*	4	0.12	>64	>64	32	>16	>128	<=8	2	1	32	>128
EURL ENT 12.5	*Enterococcus faecium*	8	0.06	1	>64	8	>16	2	<=8	2	4	32	32
EURL ENT 12.6	*Enterococcus faecium*	2	0.12	<=0.5	64	16	4	>128	1024	2	8	128	2
EURL ENT 12.7	*Enterococcus faecalis*	1	0.12	<=0.5	2	64	>16	>128	>1024	2	8	64	<=1
EURL ENT 12.8	*Enterococcus faecalis*	4	0.12	<=0.5	1	128	1	>128	1024	2	16	128	2

Expected interpretation

Strain ID	Species	Antimicrobial											
		DAP	TIG	TEI	AMP	CHL	CIP	ERY	GEN	LZD	Q-D	TET	VAN
EURL ENT 12.1	*Enterococcus faecium*	S	S	R	S	S	S	S	S	S	S	R	R
EURL ENT 12.2	*Enterococcus faecalis*	S	S	S	S	S	S	S	S	S	NA	S	S
EURL ENT 12.3	*Enterococcus faecalis*	S	S	S	S	R	S	R	S	R	NA	R	S
EURL ENT 12.4	*Enterococcus faecium*	S	S	R	R	S	R	R	S	S	S	R	R
EURL ENT 12.5	*Enterococcus faecium*	R	S	S	R	S	R	S	S	S	S	R	R
EURL ENT 12.6	*Enterococcus faecium*	S	S	S	R	S	S	R	R	S	R	R	S
EURL ENT 12.7	*Enterococcus faecalis*	S	S	S	S	R	R	R	R	S	NA	R	S
EURL ENT 12.8	*Enterococcus faecalis*	S	S	S	S	R	S	R	R	S	NA	R	S

Abbreviations

DAP, daptomycin
TIG, tigecycline
TEI, teicoplanin
AMP, ampicillin
CHL, chloramphenicol
CIP, ciprofloxacin
ERY, erythromycin
GEN, gentamicin
LZD, linezolid
Q-D, quinupristin-dalfopristin (synercid)
TET, tetracycline
VAN, vancomycin
R, resistant
S, susceptible
NA, not applicable

Color legend

resistant
susceptible

Expected MIC values

Strain ID	Species	Antimicrobial																	
		VAN	Q-D	LZD	MUP	CLN	CHL	CIP	ERY	FOX	GEN	SMX	TET	TIA	TMP	RIF	PEN	KAN	FUS	STR
EURL ST 12.1	*Staphylococcus aureus*	<=1	<=0.5	<=1	<=0.5	<=0.12	<=4	1	<=0.25	8	>16	512	>16	<=0.5	<=2	>0.5	>2	>64	<=0.5	>32
EURL ST 12.2	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	<=0.12	8	0.5	0.5	4	<=1	>512	<=0.5	1	<=2	<=0.016	<=0.12	<=4	<=0.5	8
EURL ST 12.3	*Staphylococcus aureus*	<=1	1	2	<=0.5	>4	8	8	<=0.25	8	<=1	<=64	>16	>4	>32	<=0.016	>2	<=4	<=0.5	8
EURL ST 12.4	*Staphylococcus aureus*	<=1	2	2	<=0.5	1	8	<=0.25	0.5	4	<=1	<=64	<=0.5	>4	<=2	<=0.016	>2	<=4	<=0.5	8
EURL ST 12.5	*Staphylococcus aureus*	<=1	2	2	<=0.5	>4	16	0.5	>8	4	<=1	<=64	>16	4	<=2	<=0.016	<=0.12	8	<=0.5	8
EURL ST 12.6	*Staphylococcus aureus*	<=1	>4	2	<=0.5	>4	8	<=0.25	>8	2	<=1	<=64	>16	>4	>32	<=0.016	1	<=4	<=0.5	>32
EURL ST 12.7	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	<=0.12	8	<=0.25	>8	4	<=1	<=64	<=0.5	1	<=2	<=0.016	<=0.12	<=4	>4	8
EURL ST 12.8	*Staphylococcus aureus*	<=1	<=0.5	2	<=0.5	<=0.12	8	0.5	0.5	8	<=1	>512	<=0.5	<=0.5	<=2	<=0.016	>2	<=4	<=0.5	8

Expected interpretation

Strain ID	Species	Antimicrobial																		MRSA*
		VAN	Q-D	LZD	MUP	CLN	CHL	CIP	ERY	FOX	GEN	SMX	TET	TIA	TMP	RIF	PEN	KAN	FUS	STR	
EURL ST 12.1	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	R	R	R	R	S	S	R	NA	R	S	R	positive
EURL ST 12.2	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	NA	S	S	S	negative
EURL ST 12.3	*Staphylococcus aureus*	S	S	S	S	R	S	R	S	R	S	S	R	R	R	S	NA	S	S	S	positive
EURL ST 12.4	*Staphylococcus aureus*	S	R	S	S	R	S	S	S	S	S	S	S	R	S	S	NA	S	S	S	negative
EURL ST 12.5	*Staphylococcus aureus*	S	R	S	S	R	S	S	R	S	S	S	R	R	S	S	NA	S	S	S	negative
EURL ST 12.6	*Staphylococcus aureus*	S	R	S	S	R	S	S	R	S	S	S	R	R	R	S	NA	S	S	R	negative
EURL ST 12.7	*Staphylococcus aureus*	S	S	S	S	S	S	S	R	S	S	S	S	S	S	S	NA	S	R	S	negative
EURL ST 12.8	*Staphylococcus aureus*	S	S	S	S	S	S	S	S	R	S	R	S	S	S	S	NA	S	S	S	positive

Abbreviations

VAN, vancomycin
Q-D, quinupristin-dalfopristin (synercid)
LZD, linezolid
MUP, muprocin
CLN, clindamycin
CHL, chloramphenicol
CIP, ciprofloxacin
ERY, erythromycin
FOX, cefoxitin
GEN, gentamicin
SMX, sulphamethoxazole
TET, tetracycline
TIA, tiamulin
TMP, trimethoprim
RIF, rifampicin
PEN, penicillin
KAN, kanamycin
FUS, fusidic acid
STR, streptomycin
R, resistant
S, susceptible
NA, not applicable

Color legend

resistant
susceptible

*the interpretation for MRSA is "positive" or "negative"

Expected MIC values

Strain ID	Species	Antimicrobial													
		AMP	MER	COL	CHL	CIP	TAZ	FOT	GEN	NAL	SMX	TET	TMP	AZI	TIG
EURL EC 12.1	*Escherichia coli*	>64	<=0.03	<=1	<=8	<=0.015	4	>4	<=0.5	<=4	16	<=2	<=0.25	16	<=0.25
EURL EC 12.2	*Escherichia coli*	2	<=0.03	<=1	<=8	<=0.015	<=0.5	<=0.25	<=0.5	<=4	16	<=2	<=0.25	8	<=0.25
EURL EC 12.3	*Escherichia coli*	>64	<=0.03	4	>128	>8	>8	>4	32	>128	>1024	>64	>32	64	<=0.25
EURL EC 12.4	*Escherichia coli*	>64	<=0.03	<=1	<=8	0.25	<=0.5	<=0.25	>32	>128	>1024	>64	>32	8	2
EURL EC 12.5	*Escherichia coli*	>64	4	<=1	<=8	0.03	>8	>4	2	<=4	32	<=2	<=0.25	4	<=0.25
EURL EC 12.6	*Escherichia coli*	>64	0.5	4	>128	8	<=0.5	0.5	<=0.5	>128	>1024	>64	0.5	8	0.5
EURL EC 12.7	*Escherichia coli*	>64	0.25	<=1	<=8	<=0.015	8	2	4	<=4	>1024	>64	>32	8	<=0.25
EURL EC 12.8	*Escherichia coli*	>64	<=0.03	<=1	128	0.5	8	>4	<=0.5	8	>1024	>64	<=0.25	16	<=0.25

Expected interpretation

Strain ID	Species	Antimicrobial													
		AMP	MER	COL	CHL	CIP	TAZ	FOT	GEN	NAL	SMX	TET	TMP	AZI	TIG
EURL EC 12.1	*Escherichia coli*	R	S	S	S	S	R	R	S	S	S	S	S	S	S
EURL EC 12.2	*Escherichia coli*	S	S	S	S	S	S	S	S	S	S	S	S	S	S
EURL EC 12.3	*Escherichia coli*	R	S	R	R	R	R	R	R	R	R	R	R	R	S
EURL EC 12.4	*Escherichia coli*	R	S	S	S	R	S	S	R	R	R	R	R	S	R
EURL EC 12.5	*Escherichia coli*	R	R	S	S	S	R	R	S	S	S	S	S	S	S
EURL EC 12.6	*Escherichia coli*	R	R	R	R	R	S	R	S	R	R	R	S	S	S
EURL EC 12.7	*Escherichia coli*	R	R	S	S	S	R	R	R	S	R	R	R	S	S
EURL EC 12.8	*Escherichia coli*	R	S	S	R	R	R	R	S	S	R	R	S	S	S

Abbreviations

AMP, ampicillin
MER, meropenem
COL, colistin
CHL, chloramphenicol
CIP, ciprofloxacin
TAZ, ceftazidime
FOT, cefotaxime
GEN, gentamicin
NAL, nalidixic acid
SMX, sulphamethoxazole
TET, tetracycline
TMP, trimethoprim
AZT, azithromycin
TIG, tigecycline
R, resistant
S, susceptible

Color legend

resistant
susceptible

Expected MIC values

Strain ID	Species	Antimicrobial								
		FOX	TAZ	TAZ+CL	FOT	FOT+CL	FEP	MER	IMI	ETP	TRM
EURL EC 12.1	*Escherichia coli*	4	4	0.25	>64	<=0.06	>32	<=0.03	<=0.12	<=0.015	<=4
EURL EC 12.2	*Escherichia coli*	4	<=0.25	<=0.12	<=0.25	<=0.06	<=0.06	<=0.03	<=0.12	<=0.015	<=4
EURL EC 12.3	*Escherichia coli*	8	16	0.25	>64	<=0.06	>32	<=0.03	<=0.12	0.03	8
EURL EC 12.4	*Escherichia coli*	4	<=0.25	<=0.12	<=0.25	<=0.06	0.12	<=0.03	<=0.12	<=0.015	8
EURL EC 12.5	*Escherichia coli*	>64	>128	>128	>64	>64	>32	8	4	0.5	128
EURL EC 12.6	*Escherichia coli*	8	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	>128
EURL EC 12.7	*Escherichia coli*	64	8	0.5	2	0.12	0.5	0.25	0.5	0.25	8
EURL EC 12.8	*Escherichia coli*	8	8	<=0.12	>64	<=0.06	32	<=0.03	<=0.12	0.03	4

Expected interpretation

Strain ID	Species	Antimicrobial										Presumptive mechanism mediating cephalosporin and/or carbapapenem resistance					
		FOX	TAZ	TAZ+CL*	FOT	FOT+CL*	FEP	MER	IMI	ETP	TRM**	ESBL	AmpC	ESBL+AmpC	Carbapenemase	Other	None
EURL EC 12.1	*Escherichia coli*	S	R	SYNERGY	R	SYNERGY	R	S	S	S	NA	YES	NO	NO	NO	NO	NO
EURL EC 12.2	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NO	NO	NO	NO	YES
EURL EC 12.3	*Escherichia coli*	S	R	SYNERGY	R	SYNERGY	R	S	S	S	NA	YES	NO	NO	NO	NO	NO
EURL EC 12.4	*Escherichia coli*	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NO	NO	NO	NO	NO	YES
EURL EC 12.5	*Escherichia coli*	R	R	NO SYNERGY	R	NO SYNERGY	R	R	R	R	NA	NO	NO	NO	YES	NO	NO
EURL EC 12.6	*Escherichia coli*	S	S	NO SYNERGY	R	NO SYNERGY	R	R	R	R	NA	NO	NO	NO	YES	NO	NO
EURL EC 12.7	*Escherichia coli*	R	R	SYNERGY	R	SYNERGY	R	R	S	R	NA	NO	NO	NO	YES	NO	NO
EURL EC 12.8	*Escherichia coli*	S	R	SYNERGY	R	SYNERGY	R	S	S	S	NA	YES	NO	NO	NO	NO	NO

Abbreviations

FOX, cefoxitin
TAZ, ceftazidime
TAZ+CL, ceftazidime+clavulanic acid
FOT, cefotaxime
FOT+CL, cefotaxime+clavulanic acid
FEP, cefepime
MER, meropenem
IMI, imipenem
ETP, ertapenem
TRM, temocillin
R, resistant
S, susceptible
NA, not applicable
NR, not relevant

Color legend

resistant
susceptible

Welcome letter

EURL-AR External Quality Assurance System 2018

Escherichia coli, staphylococci and enterococci

Id:xx
Address xxx

Dear XXXX,

Lyngby, 30th May 2018

Please find enclosed the bacterial strains for the EURL-AR EQAS 2018: eight *E. coli*, eight *S. aureus* and eight *Enterococcus* spp. Upon arrival to your laboratory, the strains should be stored in a dark place at 4°C for stabs, and in a dark and cool place for freeze-dried strains.

On the EURL-AR-website (www.eurl-ar.eu) the following documents relevant for this EURL-AR EQAS are available:

- Protocol for antimicrobial susceptibility testing of *E. coli*, staphylococci and enterococci and test forms for reporting results
- Instructions for Opening and Reviving Lyophilised Cultures
- Subculture and Maintenance of Quality Control Strains

We ask you to test these *E. coli,* Enterococci and *S. aureus* strains for antimicrobial susceptibility. Detailed description of the procedures to follow for antimicrobial susceptibility testing and for entering your results into the interactive web database can be found in the protocol. For accessing the database, you need this username and password.

Your username: xxx

Your password: xxx

Please keep this document
Your username and password will not appear in other documents

Results should be submitted to the database no later than **14th September 2018**.

Please acknowledge receipt of this parcel immediately upon arrival (to vabo@food.dtu.dk).
Do not hesitate to contact me for further information.

Yours sincerely,

Susanne Karlsmose Pedersen
EURL-AR EQAS-Coordinator

PROTOCOL

For antimicrobial susceptibility testing of *Escherichia coli*, enterococci and staphylococci

---

HISTORY OF CHANGES; Protocol, version 2
In Table 3, interpretative criteria corrected.

---

1 INTRODUCTION

The organisation and implementation of an External Quality Assurance System (EQAS) on antimicrobial susceptibility testing (AST) of *E. coli*, enterococci and staphylococci is among the tasks of the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR). The EC/Ent/Staph EQAS 2018 will include AST of eight *Escherichia coli*, eight enterococci and eight staphylococci

strains and AST of reference strains *E. coli* ATCC 25922 (CCM 3954), *E. faecalis* ATCC 29212 (CCM 4224), and *S. aureus* ATCC 29213 (CCM 4223).

The reference strains are included in the parcel only for new participants of the EQAS who did not receive them previously. The reference strains are original CERTIFIED cultures provided free of charge, and should be used for future internal quality control for antimicrobial susceptibility testing in your laboratory. The reference strains will not be included in the years to come. Therefore, please take proper care of these strains. Handle and maintain them as suggested in the manual 'Subculture and Maintenance of QC Strains' available on the EURL-AR website (see www.eurl-ar.eu).

Various aspects of the proficiency test scheme may from time to time be subcontracted. When subcontracting occurs it is placed with a competent subcontractor and the National Food Institute is responsible to the scheme participants for the subcontractor's work.

2 OBJECTIVES

This EQAS aims to support laboratories to assess and, if necessary, to improve the quality of results obtained for AST of pathogens of food- and animal-origin, with special regard to *E. coli*, enterococci and staphylococci. Further objectives are to evaluate and improve the comparability of surveillance data on antimicrobial susceptibility of *E. coli*, enterococci and staphylococci reported to EFSA by different laboratories.

3 OUTLINE OF THE EC/ENT/STAPH EQAS 2018

3.1 Shipping, receipt and storage of strains

In June 2018, the National Reference Laboratories for Antimicrobial Resistance (NRL-AR) will receive a parcel containing eight *E. coli*, eight enterococci and eight staphylococci strains from the DTU National Food Institute. This parcel will also contain reference strains, but only for participants who did not receive them previously.

All strains belong to UN3373, Biological substance, category B. Extended-spectrum beta-lactamase (ESBL)-producing strains as well as carbapenemase-producing strains and methicillin-resistant *Staphylococcus aureus* (MRSA) will be included in the selected material.

It is the recipients' responsibility to comply with national legislation, rules and regulation regarding the correct use and handling of the provided strains and to possess the proper equipment and protocols to handle these strains. The reference strains are shipped lyophilised, while the test strains are stab cultures. On arrival, the stab cultures must be subcultured, and all cultures should be adequately stored until testing. A suggested procedure for reconstitution of the lyophilised reference strains is presented below.

3.2 Suggested procedure for reconstitution of the lyophilised reference strains

Please refer to the document 'Instructions for opening and reviving lyophilised cultures' reported on the EURL-AR-website (see www.eurl-ar.eu).

3.3 Antimicrobial susceptibility testing

Participants should perform minimum inhibitory concentration (MIC) determination using the methods stated in the Commission Implementing Decision 2013/652/EU (international reference method (ISO standard 20776-1:2006)). For staphylococci, MIC methods should be used as well, according to the EFSA recommendations and the antimicrobials to test are those stated under the EFSA technical specifications (see Table 3). For interpretation of the results, please use the cut-off values listed in Tables 1, 2, 3 and 4 in this document. These values (except where indicated) represent the current epidemiological cut-off values developed by EUCAST (www.eucast.org), and allow categorisation of bacterial isolates into two categories: resistant and susceptible. A categorisation as intermediate is not accepted**.**

Participants will not be allowed to use disk diffusion as the current regulation and recommendations only focus on MIC determination.

3.3.1 *E. coli*

Table 1. Antimicrobials recommended for AST of *Escherichia coli* and interpretive criteria according to table 1 in Commission Implementing Decision 2013/652/EU

Antimicrobials for *E. coli*	MIC (µg/mL) **R is >**
Ampicillin, AMP	8
Azithromycin, AZI	16*
Cefotaxime, FOT	0.25
Ceftazidime, TAZ	0.5
Chloramphenicol, CHL	16
Ciprofloxacin, CIP	0.064
Colistin, COL	2
Gentamicin, GEN	2
Meropenem, MERO	0.125
Nalidixic acid, NAL	16
Sulfamethoxazole, SMX	64
Tetracycline, TET	8
Tigecycline, TGC	0.5*
Trimethoprim, TMP	2

* Tentative ECOFF

Beta-lactam resistance

Confirmatory tests for ESBL/AmpC/Carbapenemase production are mandatory on all strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) and should be performed by testing the second panel of antimicrobials (Table 2 in this document corresponding to Table 4 in Commission Implementing Decision 2013/652/EU).

Table 2. Antimicrobials recommended for additional AST of *Escherichia coli* resistant to cefotaxime, ceftazidime and/or meropenem and interpretive criteria according to table 4 in Commission Implementing Decision 2013/652/EU

Antimicrobials for *E. coli*	MIC (µg/mL) **R is >**
Cefepime, FEP	0.125
Cefotaxime, FOT	0.25
Cefotaxime + clavulanic acid (F/C)	Not applicable
Cefoxitin, FOX	8
Ceftazidime, TAZ	0.5
Ceftazidime+ clavulanic acid (T/C)	Not applicable
Ertapenem, ETP	0.064
Imipenem, IMI	0.5
Meropenem, MERO	0.125
Temocillin, TRM	>32*

*Tentative ECOFF

Confirmatory test for ESBL production requires use of both cefotaxime (FOT) and ceftazidime (TAZ) alone and in combination with a β-lactamase inhibitor (clavulanic acid). Synergy is defined as a ≥ 3 twofold concentration decrease in an MIC for either antimicrobial agent tested in combination with clavulanic acid vs. the MIC of the agent when tested alone (MIC FOT : FOT/CL or TAZ : TAZ/CL ratio ≥ 8) (CLSI M100 Table 3A, Tests for ESBLs). The presence of synergy indicates ESBL production.

Confirmatory test for carbapenemase production requires the testing of meropenem (MERO).

Detection of AmpC-type beta-lactamases can be performed by testing the bacterium for susceptibility to cefoxitin (FOX). Resistance to FOX could indicate the presence of an AmpC-type beta-lactamase.

The classification of the phenotypic beta-lactam resistance results should be based on the most recent EFSA recommendations (see the Appendix to this protocol). It is important to notice that two

cut-off values apply for cefotaxime and ceftazidime: the EUCAST cut-off values (ECOFFs: FOT>0.25 and TAZ>0.5), which are those used to define R/S, and the screening cut-off values (FOT>1 and TAZ>1), which are those applied to categorise bacterial phenotypes as ESBL, AmpC, carbapenemase, etc. based on panel 2 results (see Appendix). The screening cut-off values are higher than the ECOFF values to increase sensitivity and specificity.

3.3.2 Enterococci

Table 3. Antimicrobials recommended for AST of *Enterococcus* spp. and interpretive criteria according to table 3 in Commission Implementing Decision 2013/652/EU

Antimicrobials for enterococci	MIC (µg/mL) **R is >** *E. faecium*	MIC (µg/mL) **R is >** *E. faecalis*
Ampicillin, AMP	4	4
Chloramphenicol, CHL	32	32
Ciprofloxacin, CIP	4	4
Daptomycin, DAP	4	4
Erythromycin, ERY	4	4
Gentamicin, GEN	32	32
Linezolid, LZD	4	4
Quinupristin-dalfopristin (Synercid), SYN	4*	Intrinsically resistant
Teicoplanin, TEI	2	2
Tetracycline, TET	4	4
Tigecycline, TGC	0.25**	0.25**
Vancomycin, VAN	4	4

*DANMAP 2009 (www.danmap.org); **Tentative ECOFF

Identification of *Enterococcus* spp.

Species identification of enterococci must be performed by the NRLs using in-house methods or adopting the protocol available on the EURL-AR website under: www.eurl-ar.eu/233-protocols.htm.

3.3.3 Staphylococci

Table 4. Antimicrobials recommended for AST of *Staphylococcus aureus* and interpretive criteria according to EFSA technical specifications (EFSA Journal 2012;10(10):2897)

Antimicrobials for *S. aureus*	MIC (µg/mL) **R is >**
Cefoxitin, FOX	4
Chloramphenicol, CHL	16
Ciprofloxacin, CIP	1
Clindamycin, CLN	0.25
Erythromycin, ERY	1
Fusidic acid, FUS	0.5
Gentamicin, GEN	2
Kanamycin, KAN	8
Linezolid, LZD	4
Mupirocin, MUP	0.5
Penicillin, PEN	na
Quin.-Dalf. (Synercid), SYN	1
Rifampicin, RIF	0.032
Streptomycin, STR	16
Sulfamethoxazole, SMX	128
Tetracycline, TET	1
Tiamulin (TIA)	2
Trimethoprim, TMP	2
Vancomycin, VAN	2

na, not available

Identification of MRSA

Confirmation of *mec*A and/or *mecC* presence is mandatory in this EQAS and should be performed by the NRLs using in-house methods or adopting the protocol available on the EURL-AR website at www.eurl-ar.eu/233-protocols.htm. Results should be uploaded as 'positive' or 'negative'.

4 REPORTING OF RESULTS AND EVALUATION

Please write your results in the test forms, and enter your results into the interactive web database. In addition, we kindly ask you to report in the database the tested MIC range for the staphylococci tests (for this organism only, as it is not included in the Commission Implementing Decision 2013/652/EU). Finally, if **you did not use the cut-off values recommended in the protocol for interpretation of *Staphylococcus* AST results**, please report the breakpoints used in the database.

4.1 General recommendations for data upload

We recommend reading carefully the description reported in paragraph 5 before entering your results in the web database. **Results must be submitted no later than September 14th, 2018.** After the deadline when all participants have uploaded results, you will be able to login to the database once again, and to view and print an automatically generated report evaluating your results. Results in agreement with the expected interpretation are categorised as 'correct', while results deviating from the expected interpretation are categorised as 'incorrect'.

If you experience difficulties in entering your results, please contact us directly.

Results will be summarised in a report which will be publicly available. Only MIC-results obtained by broth microdilution will be included in the report. All data will be presented with laboratory codes. A laboratory code is known to the individual laboratory, whereas the complete list of laboratories and their codes is confidential and known only to the EURL-AR and the EU Commission. All conclusions will be public.

If you have questions, please do not hesitate to contact the EQAS Coordinator:

Susanne Karlsmose Pedersen
National Food Institute
Technical University of Denmark
Kemitorvet, Building 204, DK-2800 Lyngby

Denmark

Tel: +45 3588 6601
E-mail: suska@food.dtu.dk

5 HOW TO ENTER RESULTS IN THE INTERACTIVE DATABASE

Please read carefully this paragraph before entering the web page.
Remember that you need by your side the completed test forms and the breakpoint values you used.

Enter the EURL-AR EQAS 2018 start web page (http://eurl-ar.food.dtu.dk/01), write your username and password in lower-cases and press enter. Your username and password are indicated in the letter accompanying your strains. Do not hesitate to contact us if you experience problems with the login.

You can browse back and forth by using the Home or back keys, but please remember to save your inputs before changing pages.

5.1 AST of *E. coli*, enterococci and staphylococci

Click on either "*E. coli*", "enterococci" or "staphylococci" for input of test results based on the results you are going to upload.

Click on "Start of Data Entry - Methods and Breakpoints".

In the next page, you can navigate among fields with the Tab-key and the mouse.

Complete the fields related to the method used for antimicrobial susceptibility testing and the brand of MIC trays, etc.

Click on "save" and then go back using the tab "home" and enter another test page to upload results.

In the data entry pages, enter the obtained values and the interpretation (R, resistant or S, susceptible) for each *E. coli*, *Enterococcus* and *Staphylococcus* strain.

For *E. coli* strains, remember to report also the results for the ESBL/AmpC/Carbapenemase detection tests.
For *S. aureus* strains, remember to report also the results for presence/absence of methicillin resistance.

If you did not test for susceptibility to a given antimicrobial, please leave the field empty.

Click on "save" and then go back using the tab "home" and enter another test page to upload results.

When uploading data on the reference strains, please enter MIC values in µg/ml. Remember to use the operator keys to show symbols like "equal to", etc.

Click on "save".

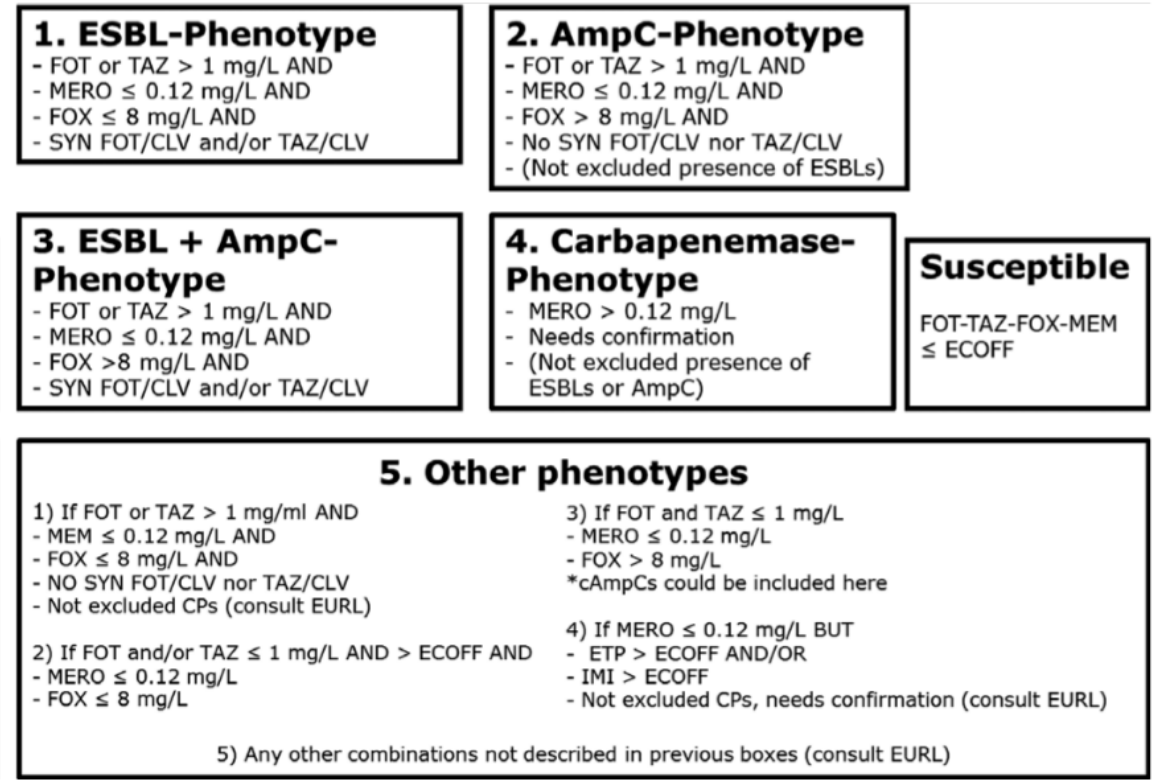
Review the input pages by browsing through the pages and make corrections if necessary. Remember to save a page if you make corrections. If you press home to leave a page without saving changes, you will see an error screen. In this case, click on "save" to save your results, browse back to the page and then continue.

Please complete the evaluation form.

Before approving your input, please be sure that you have filled in all the relevant fields because YOU CAN ONLY APPROVE ONCE! The approval blocks your data entry in the interactive database.

APPENDIX

Criteria for interpretation of *Escherichia coli*, panel 2 results



Please refer to: EFSA (European Food Safety Authority) and ECDC (European Centre for Disease Prevention and Control), 2018. The European Union summary report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2016. EFSA Journal 2018;16(2):5182, 270 pp. doi:10.2903/j.efsa.2018.5182 (page 46).

DTU Food
National Food Institute

Antimicrobial susceptibility testing of *Escherichia coli*, enterococci and staphylococci

TEST FORMS

Name:
Name of laboratory:
Name of institute:
City:
Country:
E-mail:
Fax:

Comments:

TEST FORMS METHODS - Enterococci

Which method did you use for antimicrobial susceptibility testing of enterococci in this EQAS:

☐ MIC – Broth microdilution
☐ MIC – Agar dilution (note: not evaluated in the final report)
Brand**:**

How many *Enterococcus* spp. isolates does your laboratory annually isolate:

How many *Enterococcus* spp. isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

TEST FORMS METHODS - Staphylococci

Which method did you use for antimicrobial susceptibility testing of staphylococci in this EQAS:

☐ MIC – Broth microdilution
☐ MIC – Agar dilution (note: not evaluated in the final report)
Brand**:**

How many *Staphylococcus* spp. isolates does your laboratory annually isolate:

How many *Staphylococcus* spp. isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

Antimicrobial	General information The relevant information in the four columns below should be reported			
	Test-range for MIC (µg/ml)	Resistant (µg/ml)	Intermediate (µg/ml)	Susceptible (µg/ml)
Cefoxitin, FOX		≤		≥
Chloramphenicol, CHL		≤		≥
Ciprofloxacin, CIP		≤		≥
Clindamycin, CLN		≤		≥
Erythromycin, ERY		≤		≥
Fusidic acid, FUS		≤		≥
Gentamicin, GEN		≤		≥
Kanamycin, KAN		≤		≥
Linezolid, LZD		≤		≥
Mupirocin, MUP		≤		≥
Penicillin, PEN		≤		≥
Quin.-Dalf. (Synercid), SYN		≤		≥
Rifampicin, RIF		≤		≥
Streptomycin, STR		≤		≥
Sulfamethoxazole, SMX		≤		≥
Tetracycline, TET		≤		≥
Tiamulin (TIA)		≤		≥
Trimethoprim, TMP		≤		≥
Vancomycin, VAN		≤		≥

TEST FORMS METHODS – *Escherichia coli*

Which method did you use for antimicrobial susceptibility testing of *E. coli* in this EQAS:

☐ MIC – Broth microdilution
☐ MIC – Agar dilution (note: not evaluated in the final report)

Brand**:**

Incubation conditions: °C/ h

How many *E. coli* isolates does your laboratory annually isolate:

How many *E. coli* isolates does your laboratory annually test for antimicrobial susceptibility by a MIC method:

Which method was followed for the preparation of the inoculum? Please describe:

- Which standard was followed (TREK, CLSI…)
- Which solvent was used for the preparation of the 0.5 McFarland solution (water, saline)
- Please describe in detail how you prepared the dilution of the inoculum (including the volume in final MH-dilution and intended dilution level; e.g. diluted 1:1000 by adding 10µl of 0.5 McFarland solution in 10ml MH broth, for an expected inoculum of $1*10^5$ CFU/ml)

Comments or additional information:

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.1 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.2 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.3 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.4 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.5 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.6 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

TEST FORM - Enterococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.7 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
Enterococci EURL ENT. 12.8 ☐ *E. faecium* ☐ *E. faecalis*	Ampicillin AMP			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Daptomycin, DAP			
	Erythromycin, ERY			
	Gentamicin, GEN			
	Linezolid, LZD			
	Quin.-Dalf. (Synercid), SYN			
	Teicoplanin, TEI			
	Tetracycline, TET			
	Tigecycline, TGC			
	Vancomycin, VAN			

TEST FORM - Enterococci

Antimicrobial susceptibility testing of reference strain *Enterococcus faecalis* ATCC 29212

Antimicrobial	MIC-value (µg/ml)
Ampicillin, AMP	
Chloramphenicol, CHL	
Ciprofloxacin, CIP	
Daptomycin, DAP	
Erythromycin, ERY	
Gentamicin, GEN	
Linezolid, LZD	
Quinupristin-Dalfopristin (Synercid), SYN	
Teicoplanin, TEI	
Tetracycline, TET	
Tigecycline, TIG	
Vancomycin, VAN	

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.1	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.2	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.3	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.4	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.5	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.6	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.7	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORMS - Staphylococci

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
S. aureus EURL ST 12.8	Cefoxitin, FOX			
	Chloramphenicol, CHL			
	Ciprofloxacin, CIP			
	Clindamycin, CLN			
	Erythromycin, ERY			
	Fusidic acid, FUS			
	Gentamicin, GEN			
	Kanamycin, KAN			
	Linezolid, LZD			
	Mupirocin, MUP			
	Penicillin, PEN			
	Quin.-Dalf. (Synercid), SYN			
	Rifampicin, RIF			
	Streptomycin, STR			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tiamulin (TIA)			
	Trimethoprim, TMP			
	Vancomycin, VAN			

Methicillin resistance (MRSA)	☐ Positive ☐ Negative

TEST FORM - Staphylococci

Antimicrobial susceptibility testing of reference strain *S. aureus* ATCC 29213 (MIC)

Antimicrobial	MIC-value (µg/ml)
Cefoxitin, FOX	
Chloramphenicol, CHL	
Ciprofloxacin, CIP	
Clindamycin, CLN	
Erythromycin, ERY	
Fusidic acid, FUS	
Gentamicin, GEN	
Kanamycin, KAN	
Linezolid, LZD	
Mupirocin, MUP	
Penicillin, PEN	
Quin.-Dalf. (Synercid), SYN	
Rifampicin, RIF	
Streptomycin, STR	
Sulfamethoxazole, SMX	
Tetracycline, TET	
Tiamulin (TIA)	
Trimethoprim, TMP	
Vancomycin, VAN	

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.1	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.1	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.2	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.2	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.3	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.3	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.4	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.4	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.5	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.5	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.6	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.6	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL
☐ Presumptive ESBL+ AmpC
☐ Presumptive AmpC
☐ Presumptive carbapenemase
☐ Other phenotype
☐ Susceptible

Comments (include optional genotype or other results):


European
Union
Reference
Laboratory
Antimicrobial
Resistance

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.7	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.7	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.8	Ampicillin, AMP			
	Azithromycin, AZT			
	Cefotaxime, FOT			
	Ceftazidime, TAZ			
	Chloramphenicol, CHL			
	Ciprofloxacin CIP			
	Colistin, COL			
	Gentamicin, GEN			
	Meropenem, MERO			
	Nalidixic acid, NAL			
	Sulfamethoxazole, SMX			
	Tetracycline, TET			
	Tigecycline, TGC			
	Trimethoprim, TMP			

All strains resistant to cefotaxime (FOT), ceftazidime (TAZ) and/or meropenem (MERO) should be tested in the second panel for confirmatory tests for ESBL/AmpC/carbapenemase production. See further description of confirmatory tests in the protocol section '*3.3.1 E. coli*'.

Strain	Antimicrobial	Results and interpretation		
		≤ >	MIC-value (µg/ml)	S / R
E. coli EURL EC 12.8	Cefepime, FEP			
	Cefotaxime, FOT			
	Cefotaxime + clavulanic acid (F/C)			
	Cefoxitin, FOX			
	Ceftazidime, TAZ			
	Ceftazidime+ clavulanic acid (T/C)			
	Ertapenem, ETP			
	Imipenem, IMI			
	Meropenem, MERO			
	Temocillin, TRM			

Interpretation of PANEL 2 results:

☐ Presumptive ESBL ☐ Presumptive AmpC ☐ Other phenotype
☐ Presumptive ESBL+ AmpC ☐ Presumptive carbapenemase ☐ Susceptible

Comments (include optional genotype or other results):

TEST FORM – *E. coli*

Antimicrobial susceptibility testing of reference strain *E. coli* ATCC 25922

	Antimicrobial	MIC-value (µg/ml)
1st panel	Ampicillin, AMP	
	Azithromycin, AZT	
	Cefotaxime, FOT	
	Ceftazidime, TAZ	
	Chloramphenicol, CHL	
	Ciprofloxacin, CIP	
	Colistin, COL	
	Gentamicin, GEN	
	Meropenem, MERO	
	Nalidixic acid, NAL	
	Sulfamethoxazole, SMX	
	Tetracycline, TET	
	Tigecycline, TGC	
	Trimethoprim, TMP	
2nd panel	Cefepime, FEP	
	Cefotaxime, FOT	
	Cefotaxime + clavulanic acid (F/C)	
	Cefoxitin, FOX	
	Ceftazidime, TAZ	
	Ceftazidime+ clavulanic acid (T/C)	
	Ertapenem, ETP	
	Imipenem, IMI	
	Meropenem, MERO	
	Temocillin, TRM	

INSTRUCTIONS FOR OPENING AND REVIVING LYOPHILISED CULTURES

Instructions adjusted from Czech Collection of Microorganisms (CCM) document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz.

Lyophilised cultures are supplied in vacuum-sealed ampoules. Care should be taken in opening the ampoule. All instructions given below should be followed closely to ensure the safety of the person who opens the ampoule and to prevent contamination of the culture.

a. Check the number of the culture on the label inside the ampoule
b. Make a file cut on the ampoule near the middle of the plug (see Figure 1)
c. Disinfect the ampoule with alcohol-dampened gauze or alcohol-dampened cotton wool from just below the plug to the pointed end
d. Apply a red-hot glass rod to the file cut to crack the glass and allow air to enter slowly into the ampoule
e. Remove the pointed end of the ampoule into disinfectant
f. Add about 0.3 ml appropriate broth to the dried suspension using a sterile Pasteur pipette and mix carefully to avoid creating aerosols. Transfer the contents to one or more suitable solid and /or liquid media
g. Incubate the inoculated medium at appropriate conditions for several days
h. Autoclave or disinfect effectively the used Pasteur pipette, the plug and all the remains of the original ampoule before discarding

Notes:

- Cultures should be grown on media and under conditions as recommended in the CCM catalogue (see http://www.sci.muni.cz)
- Cultures may need at least one subculturing before they can be optimally used in experiments
- Unopened ampoules should be kept in a dark and cool place!

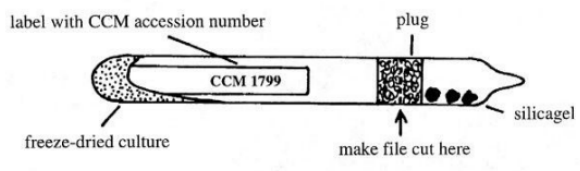


Figure 1: from CCM document 'Instructions for Opening and Reviving of Freeze-Dried Bacteria and Fungi' available on http://www.sci.muni.cz

SUBCULTURE AND MAINTENANCE OF QUALITY CONTROL STRAINS

1.1 Purpose

Improper storage and repeated subculturing of bacteria can produce alterations in antimicrobial susceptibility test results. The Clinical and Laboratory Standards Institute (CLSI, formerly NCCLS) has published a guideline for Quality Control (QC) stock culture maintenance to ensure consistent antimicrobial susceptibility test results.

1.2 References

M100-S24, January 2014 (Performance Standards for Antimicrobial Susceptibility Testing)

M7-A9, January 2012 (Methods for Dilution Antimicrobial Susceptibility Test for Bacteria That Grow Aerobically; Approved Standard)

1.3 Definition of Terms

Reference Culture: A reference culture is a microorganism preparation that is acquired from a culture type collection.

Reference Stock Culture: A reference stock culture is a microorganism preparation that is derived from a reference culture. Guidelines and standards outline how reference stock cultures must be processed and stored.

Working Stock Cultures: A working stock culture is growth derived from a reference stock culture. Guidelines and standards outline how working stock cultures must be processed and how often they can be subcultured.

Subcultures (Passages): A subculture is simply the transfer of established microorganism growth on media to fresh media. The subsequent growth on the fresh media constitutes a subculture or passage. Growing a reference culture or reference stock culture from its preserved status (frozen or lyophilized) is not a subculture. The preserved microorganism is not in a stage of established growth until it is thawed or hydrated and grown for the first time

1.4 Important Considerations

- Do not use disc diffusion strains for MIC determination.
- Obtain QC strains from a reliable source such as ATCC
- CLSI requires that QC be performed either on the same day or weekly (only after 30 day QC validation)
- Any changes in materials or procedure must be validated with QC before implemented
- For example: Agar and broth methods may give different QC ranges for drugs such as glycopeptides, aminoglycosides and macrolides
- Periodically perform colony counts to check the inoculum preparation procedure

- Ideally, test values should be in the middle of the acceptable range
- Graphing QC data points over time can help identify changes in data helpful for troubleshooting problems

1.5 Storage of Reference Strains

Preparation of stock cultures

- Use a suitable stabilizer such as 50% fetal calf serum in broth, 10-15% glycerol in tryptic soy broth, defibrinated sheep blood or skim milk to prepare multiple aliquots.
- Store at -20°C, -70°C or liquid nitrogen. (Alternatively, freeze dry.)
- Before using rejuvenated strains for QC, subculture to check for purity and viability.

Working cultures

- Set up on agar slants with appropriate medium, store at 4-8°C and subculture weekly.
- Replace the working strain with a stock culture at least monthly.
- If a change in the organisms inherent susceptibility occurs, obtain a fresh stock culture or a new strain from a reference culture collection e.g. ATCC.

1.6 Frequency of Testing

Weekly vs. daily testing

Weekly testing is possible if the lab can demonstrate satisfactory performance with daily testing as follows:

- Documentation showing reference strain results from 30 consecutive test days were within the acceptable range.
- For each antimicrobial/organism combination, no more than 3 out of 30 MIC values may be outside the acceptable range.

When the above are fulfilled, each quality control strain may be tested once a week and whenever any reagent component is changed.

Corrective Actions

If an MIC is outside the range in weekly testing, corrective action is required as follows:

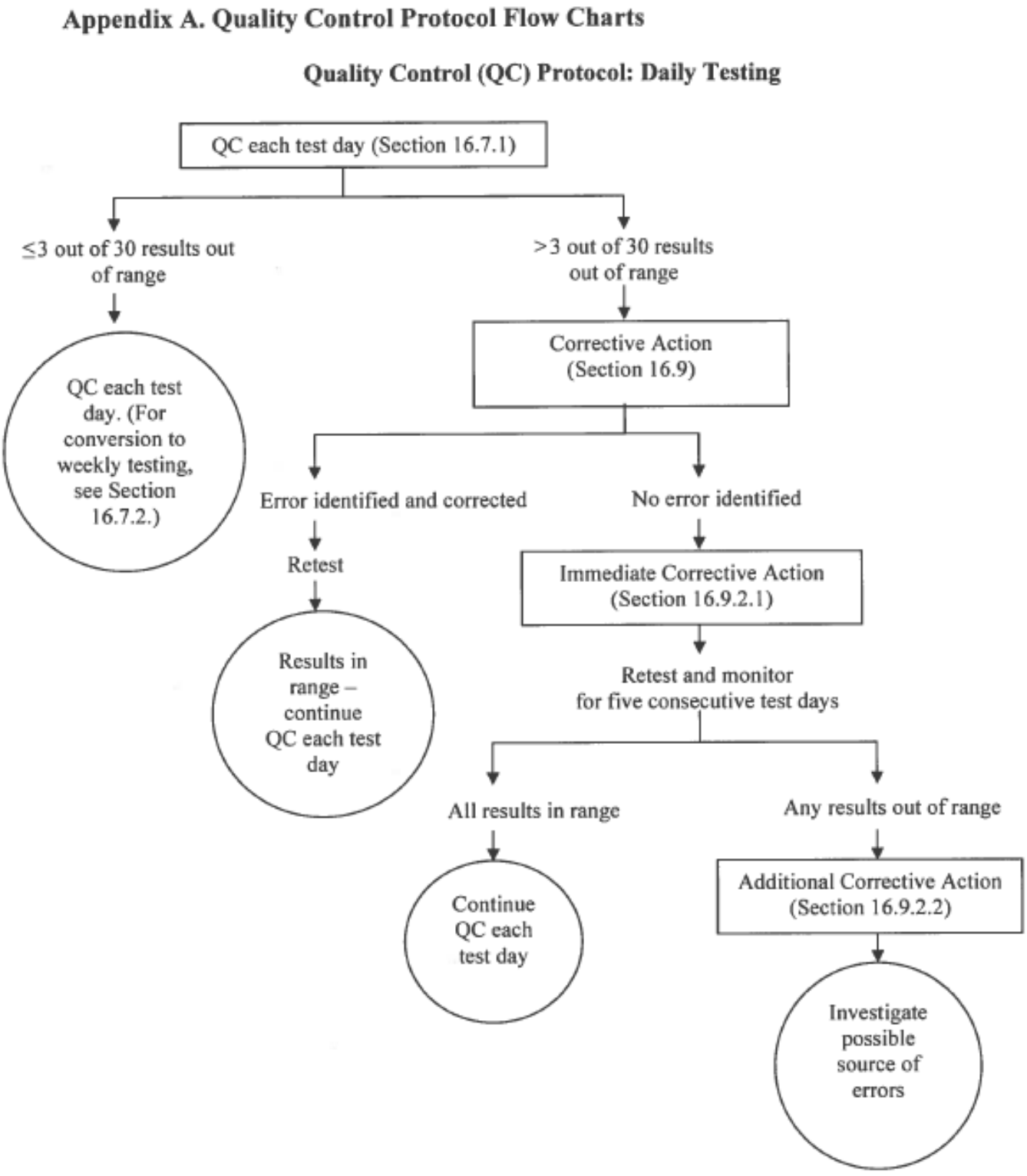
- Repeat the test if there is an obvious error e.g. wrong strain or incubation conditions used
- If there is no obvious error, return to daily control testing

The problem is considered resolved only after the reference strain is tested for 5 consecutive days and each drug/organism result is within specification on each day.

If the problem cannot be resolved, continue daily testing until the errors are identified.

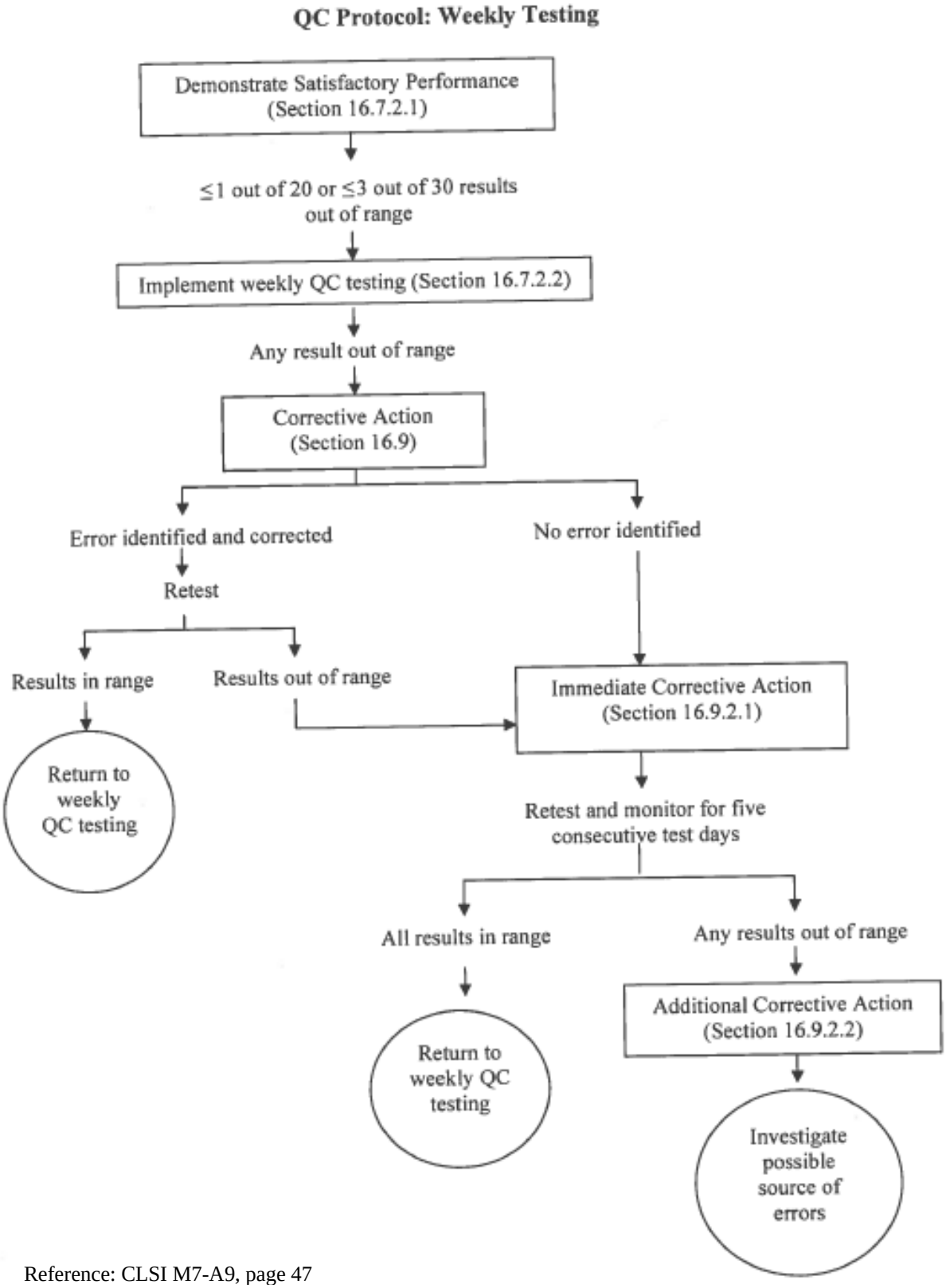
Repeat the 30 days validation before resuming weekly testing.

DAILY MIC QC CHART



Reference: CLSI M7-A9, page 46

Appendix A. (Continued)



Reference: CLSI M7-A9, page 47

Quality control ranges - *Escherichia coli* ATCC 25922, Panel 1

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Ampicillin	AMP	2	8
Azithromycin	AZI	NA	NA
Cefotaxime	FOT	0.03	0.12
Ceftazidime	TAZ	0.06	0.5
Chloramphenicol	CHL	2	8
Ciprofloxacin	CIP	0.004	0.015
Colistin	COL	0.25	2
Gentamicin	GEN	0.25	1
Meropenem	MER	0.008	0.06
Nalidixic acid	NAL	1	4
Sulfamethoxazole	SMX	8	32
Tetracycline	TET	0.5	2
Tigecycline	TGC	0.03	0.25
Trimethoprim	TMP	0.5	2

Quality control ranges - *Escherichia coli* ATCC 25922, Panel 2

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Cefepime	FEP	0.015	0.12
Cefotaxime/clavulanic acid	F/C	NA	na
Cefotaxime	FOT	0.03	0.12
Cefoxitin	FOX	2	8
Ceftazidime	TAZ	0.06	0.5
Ceftazidime/clavulanic acid	T/C	NA	NA
Ertapenem	ETP	0.004	0.015
Imipenem	IMI	0.06	0.25
Meropenem	MER	0.008	0.06
Temocillin	TRM	NA	NA

Legend

NA, not available

Quality control ranges - *Enterococcus faecalis* ATCC 29212

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Ampicillin	AMP	0.5	2
Chloramphenicol	CHL	4	16
Ciprofloxacin	CIP	0.25	2
Daptomycin	DAP	1*	4*
Erythromycin	ERY	1	4
Gentamicin	GEN	4	16
Linezolid	LZD	1	4
Quinupristin-dalfopristin	SYN	2	8
Teicoplanin	TEI	0.25	1
Tetracycline	TET	8	32
Tigecycline	TGC	0.03	0.12
Vancomycin	VAN	1	4

Legend

*when medium is supplemented with calcium to a final concentration of 50 µg/ml

NA, not available

Quality control ranges - *Staphylococcus aureus* ATCC 25923

Antimicrobial	Abbreviation	Min. (µg/ml)	Max. (µg/ml)
Cefoxitin	FOX	1	4
Chloramphenicol	CHL	2	16
Ciprofloxacin	CIP	0.12	0.5
Clindamycin	CLN	0.06	0.25
Erythromycin	ERY	0.25	1
Fusidic acid	FUS	0.06	0.25
Gentamicin	GEN	0.12	1
Kanamycin	KAN	1	4
Linezolid	LZD	1	4
Mupirocin	MUP	NA	NA
Penicillin	PEN	0.25	2
Quinupristin-dalfopristin	SYN	0.25	1
Rifampicin	RIF	0.004	0.016
Streptomycin	STR	NA	NA
Sulfamethoxazole	SMX	32	128
Sulfamethoxazole-trimethoprim	SXT	0	0.5
Tetracycline	TET	0.12	1
Tiamulin	TIA	NA	NA
Trimethoprim	TMP	1	4
Vancomycin	VAN	0.5	2

Legend

NA, not available

***Enterococcus faecalis* ATCC 29212**

Lab. code	Antimicrobial	Operator	Read_values	Min. value	Max. value	Score
2	Ampicillin	=	1	0,5	2	1
2	Chloramphenicol	=	8	4	16	1
2	Ciprofloxacin	=	1	0,25	2	1
2	Daptomycin	=	2	1	4	1
2	Erythromycin	=	4	1	4	1
2	Gentamicin	<=	8	4	16	1
2	Linezolid	=	2	1	4	1
2	Teicoplanin	<=	0,5	0,25	1	1
2	Tetracycline	=	32	8	32	1
2	Tigecycline	=	0,12	0,03	0,12	1
2	Vancomycin	=	2	1	4	1
4	Ampicillin		1	0,5	2	1
4	Chloramphenicol		8	4	16	1
4	Ciprofloxacin		1	0,25	2	1
4	Daptomycin		4	1	4	1
4	Erythromycin	<=	1	1	4	1
4	Gentamicin		16	4	16	1
4	Linezolid		2	1	4	1
4	Teicoplanin	<=	0,5	0,25	1	1
4	Tetracycline		16	8	32	1
4	Tigecycline		0,06	0,03	0,12	1
4	Vancomycin	<=	1	1	4	1
9	Ampicillin	=	1	0,5	2	1
9	Chloramphenicol	=	8	4	16	1
9	Ciprofloxacin	=	1	0,25	2	1
9	Daptomycin	=	2	1	4	1
9	Erythromycin	=	2	1	4	1
9	Gentamicin	<=	8	4	16	1
9	Linezolid	=	2	1	4	1
9	Teicoplanin	<=	0,5	0,25	1	1
9	Tetracycline	=	16	8	32	1
9	Tigecycline	=	0,06	0,03	0,12	1
9	Vancomycin	=	4	1	4	1
11	Ampicillin	<=	0,5	0,5	2	1
11	Chloramphenicol	<=	4	4	16	1
11	Ciprofloxacin	=	0,5	0,25	2	1
11	Daptomycin	=	2	1	4	1
11	Erythromycin	=	4	1	4	1
11	Gentamicin	=	16	4	16	1
11	Linezolid	=	1	1	4	1
11	Teicoplanin	<=	0,5	0,25	1	1
11	Tetracycline	=	32	8	32	1
11	Tigecycline	=	0,06	0,03	0,12	1
11	Vancomycin	=	2	1	4	1
12	Ampicillin	=	1	0,5	2	1
12	Chloramphenicol	=	8	4	16	1
12	Ciprofloxacin	=	1	0,25	2	1
12	Daptomycin	=	2	1	4	1
12	Erythromycin	=	2	1	4	1

12	Gentamicin	<=	8	4	16	1
12	Linezolid	=	2	1	4	1
12	Teicoplanin	<=	0,5	0,25	1	1
12	Tetracycline	=	32	8	32	1
12	Tigecycline	=	0,12	0,03	0,12	1
12	Vancomycin	=	2	1	4	1
16	Ampicillin	=	1	0,5	2	1
16	Chloramphenicol	=	8	4	16	1
16	Ciprofloxacin	=	1	0,25	2	1
16	Daptomycin	=	2	1	4	1
16	Erythromycin	=	2	1	4	1
16	Gentamicin	<=	8	4	16	1
16	Linezolid	=	2	1	4	1
16	Teicoplanin	<=	0,5	0,25	1	1
16	Tetracycline	=	32	8	32	1
16	Tigecycline	=	0,25	0,03	0,12	0
16	Vancomycin	=	2	1	4	1
17	Ampicillin	=	1	0,5	2	1
17	Chloramphenicol	=	8	4	16	1
17	Ciprofloxacin	=	1	0,25	2	1
17	Daptomycin	=	2	1	4	1
17	Erythromycin	=	2	1	4	1
17	Gentamicin	<=	8	4	16	1
17	Linezolid	=	2	1	4	1
17	Teicoplanin	<=	0,5	0,25	1	1
17	Tetracycline	=	32	8	32	1
17	Tigecycline	=	0,12	0,03	0,12	1
17	Vancomycin	=	2	1	4	1
19	Ampicillin	=	2	0,5	2	1
19	Chloramphenicol	=	8	4	16	1
19	Ciprofloxacin	=	1	0,25	2	1
19	Daptomycin	=	4	1	4	1
19	Erythromycin	=	2	1	4	1
19	Gentamicin	=	16	4	16	1
19	Linezolid	=	2	1	4	1
19	Teicoplanin	<=	0,5	0,25	1	1
19	Tetracycline	=	32	8	32	1
19	Tigecycline	=	0,12	0,03	0,12	1
19	Vancomycin	=	2	1	4	1
20	Ampicillin	=	1	0,5	2	1
20	Chloramphenicol	=	8	4	16	1
20	Ciprofloxacin	=	1	0,25	2	1
20	Daptomycin	=	4	1	4	1
20	Erythromycin	=	2	1	4	1
20	Gentamicin	<=	8	4	16	1
20	Linezolid	=	2	1	4	1
20	Teicoplanin	<=	0,5	0,25	1	1
20	Tetracycline	=	32	8	32	1
20	Tigecycline	=	0,25	0,03	0,12	0
20	Vancomycin	<=	1	1	4	1
22	Ampicillin	=	2	0,5	2	1

22	Chloramphenicol	=	8	4	16	1
22	Ciprofloxacin	=	0,5	0,25	2	1
22	Daptomycin	=	2	1	4	1
22	Erythromycin	=	2	1	4	1
22	Gentamicin	<=	8	4	16	1
22	Linezolid	=	2	1	4	1
22	Teicoplanin	<=	0,5	0,25	1	1
22	Tetracycline	=	16	8	32	1
22	Tigecycline	=	0,12	0,03	0,12	1
22	Vancomycin	=	2	1	4	1
23	Ampicillin	<=	0,5	0,5	2	1
23	Chloramphenicol	<=	4	4	16	1
23	Ciprofloxacin		0,5	0,25	2	1
23	Daptomycin		1	1	4	1
23	Erythromycin		2	1	4	1
23	Gentamicin	<=	8	4	16	1
23	Linezolid		1	1	4	1
23	Teicoplanin	<=	0,5	0,25	1	1
23	Tetracycline		16	8	32	1
23	Tigecycline	<=	0,03	0,03	0,12	1
23	Vancomycin	<=	1	1	4	1
25	Ampicillin	=	1	0,5	2	1
25	Chloramphenicol	=	8	4	16	1
25	Ciprofloxacin	=	1	0,25	2	1
25	Daptomycin	=	2	1	4	1
25	Erythromycin	=	2	1	4	1
25	Gentamicin	<=	8	4	16	1
25	Linezolid	=	2	1	4	1
25	Teicoplanin	<=	0,5	0,25	1	1
25	Tetracycline	=	32	8	32	1
25	Tigecycline	=	0,25	0,03	0,12	0
25	Vancomycin	=	4	1	4	1
26	Ampicillin	=	1	0,5	2	1
26	Chloramphenicol	=	8	4	16	1
26	Ciprofloxacin	=	1	0,25	2	1
26	Daptomycin	=	2	1	4	1
26	Erythromycin	=	2	1	4	1
26	Gentamicin	<=	8	4	16	1
26	Linezolid	=	2	1	4	1
26	Teicoplanin	<=	0,5	0,25	1	1
26	Tetracycline	=	16	8	32	1
26	Tigecycline	=	0,12	0,03	0,12	1
26	Vancomycin	<=	1	1	4	1
29	Ampicillin	=	1	0,5	2	1
29	Chloramphenicol	=	8	4	16	1
29	Ciprofloxacin	=	1	0,25	2	1
29	Daptomycin	=	2	1	4	1
29	Erythromycin	=	2	1	4	1
29	Gentamicin	<=	8	4	16	1
29	Linezolid	=	2	1	4	1
29	Teicoplanin	<=	0,5	0,25	1	1

29	Tetracycline	=	16	8	32	1
29	Tigecycline	=	0,06	0,03	0,12	1
29	Vancomycin	=	2	1	4	1
30	Ampicillin	=	1	0,5	2	1
30	Chloramphenicol	=	8	4	16	1
30	Ciprofloxacin	=	0,5	0,25	2	1
30	Daptomycin	=	2	1	4	1
30	Erythromycin	=	4	1	4	1
30	Gentamicin	<=	8	4	16	1
30	Linezolid	=	2	1	4	1
30	Teicoplanin	<=	0,5	0,25	1	1
30	Tetracycline	=	32	8	32	1
30	Tigecycline	=	0,12	0,03	0,12	1
30	Vancomycin	=	2	1	4	1
32	Ampicillin	=	1	0,5	2	1
32	Chloramphenicol	=	8	4	16	1
32	Ciprofloxacin	=	0,5	0,25	2	1
32	Daptomycin	=	1	1	4	1
32	Erythromycin	=	2	1	4	1
32	Gentamicin	<=	8	4	16	1
32	Linezolid	=	2	1	4	1
32	Teicoplanin	<=	0,5	0,25	1	1
32	Tetracycline	=	16	8	32	1
32	Tigecycline	=	0,12	0,03	0,12	1
32	Vancomycin	<=	1	1	4	1
33	Ampicillin	=	1	0,5	2	1
33	Chloramphenicol	<=	4	4	16	1
33	Ciprofloxacin	=	0,5	0,25	2	1
33	Daptomycin	=	2	1	4	1
33	Erythromycin	=	4	1	4	1
33	Gentamicin	<=	8	4	16	1
33	Linezolid	=	2	1	4	1
33	Teicoplanin	<=	0,5	0,25	1	1
33	Tetracycline	=	16	8	32	1
33	Tigecycline	<=	0,03	0,03	0,12	1
33	Vancomycin	=	2	1	4	1
34	Ampicillin	<=	0,5	0,5	2	1
34	Chloramphenicol	<=	4	4	16	1
34	Ciprofloxacin	=	1	0,25	2	1
34	Daptomycin	=	1	1	4	1
34	Erythromycin	<=	1	1	4	1
34	Gentamicin	<=	8	4	16	1
34	Linezolid	=	1	1	4	1
34	Teicoplanin	<=	0,5	0,25	1	1
34	Tetracycline	=	16	8	32	1
34	Tigecycline	=	0,12	0,03	0,12	1
34	Vancomycin	<=	1	1	4	1
36	Ampicillin	=	2	0,5	2	1
36	Chloramphenicol	=	8	4	16	1
36	Ciprofloxacin	=	1	0,25	2	1
36	Daptomycin	=	2	1	4	1

36	Erythromycin	=	2	1	4	1
36	Gentamicin	=	16	4	16	1
36	Linezolid	=	2	1	4	1
36	Teicoplanin	<=	0,5	0,25	1	1
36	Tetracycline	=	32	8	32	1
36	Tigecycline	=	0,25	0,03	0,12	0
36	Vancomycin	=	4	1	4	1
39	Ampicillin	=	1	0,5	2	1
39	Chloramphenicol	<=	4	4	16	1
39	Ciprofloxacin	=	1	0,25	2	1
39	Daptomycin	=	2	1	4	1
39	Erythromycin	=	2	1	4	1
39	Gentamicin	<=	8	4	16	1
39	Linezolid	=	2	1	4	1
39	Teicoplanin	<=	0,5	0,25	1	1
39	Tetracycline	=	32	8	32	1
39	Tigecycline	=	0,06	0,03	0,12	1
39	Vancomycin	=	2	1	4	1
40	Ampicillin	=	1	0,5	2	1
40	Chloramphenicol	=	4	4	16	1
40	Ciprofloxacin	=	0,5	0,25	2	1
40	Daptomycin	=	1	1	4	1
40	Erythromycin	=	1	1	4	1
40	Gentamicin	=	16	4	16	1
40	Linezolid	=	1	1	4	1
40	Teicoplanin	=	0,5	0,25	1	1
40	Tetracycline	=	8	8	32	1
40	Tigecycline	=	0,06	0,03	0,12	1
40	Vancomycin	=	1	1	4	1
41	Ampicillin	=	1	0,5	2	1
41	Chloramphenicol	=	8	4	16	1
41	Ciprofloxacin	=	0,25	0,25	2	1
41	Daptomycin	=	1	1	4	1
41	Erythromycin	<=	1	1	4	1
41	Gentamicin	<=	8	4	16	1
41	Linezolid	=	1	1	4	1
41	Teicoplanin	<=	0,5	0,25	1	1
41	Tetracycline	=	8	8	32	1
41	Tigecycline	=	0,06	0,03	0,12	1
41	Vancomycin	=	2	1	4	1
42	Ampicillin	=	1	0,5	2	1
42	Chloramphenicol	=	8	4	16	1
42	Ciprofloxacin	=	1	0,25	2	1
42	Daptomycin	=	4	1	4	1
42	Erythromycin	=	2	1	4	1
42	Gentamicin	<=	8	4	16	1
42	Linezolid	=	2	1	4	1
42	Teicoplanin	<=	0,5	0,25	1	1
42	Tetracycline	=	32	8	32	1
42	Tigecycline	=	0,12	0,03	0,12	1
42	Vancomycin	=	2	1	4	1

45	Ampicillin	<=	0,5	0,5	2	1
45	Chloramphenicol	<=	4	4	16	1
45	Ciprofloxacin	=	0,5	0,25	2	1
45	Daptomycin	=	2	1	4	1
45	Erythromycin	=	2	1	4	1
45	Gentamicin	<=	8	4	16	1
45	Linezolid	=	1	1	4	1
45	Teicoplanin	<=	0,5	0,25	1	1
45	Tetracycline	=	16	8	32	1
45	Tigecycline	=	0,06	0,03	0,12	1
45	Vancomycin	=	2	1	4	1
56	Ampicillin	=	2	0,5	2	1
56	Chloramphenicol	=	8	4	16	1
56	Ciprofloxacin	=	1	0,25	2	1
56	Daptomycin	=	2	1	4	1
56	Erythromycin	=	4	1	4	1
56	Gentamicin	<=	8	4	16	1
56	Linezolid	=	2	1	4	1
56	Teicoplanin	<=	0,5	0,25	1	1
56	Tetracycline	=	8	8	32	1
56	Tigecycline	=	0,12	0,03	0,12	1
56	Vancomycin	=	2	1	4	1
59	Ampicillin	<=	0,5	0,5	2	1
59	Chloramphenicol	=	8	4	16	1
59	Ciprofloxacin	=	1	0,25	2	1
59	Daptomycin	=	2	1	4	1
59	Erythromycin	=	2	1	4	1
59	Gentamicin	=	16	4	16	1
59	Linezolid	=	2	1	4	1
59	Teicoplanin	<=	0,5	0,25	1	1
59	Tetracycline	=	32	8	32	1
59	Tigecycline	=	0,12	0,03	0,12	1
59	Vancomycin	=	2	1	4	1
60	Ampicillin	=	1	0,5	2	1
60	Chloramphenicol	=	8	4	16	1
60	Ciprofloxacin	=	1	0,25	2	1
60	Daptomycin	=	4	1	4	1
60	Erythromycin	=	2	1	4	1
60	Gentamicin	<=	8	4	16	1
60	Linezolid	=	2	1	4	1
60	Teicoplanin	<=	0,5	0,25	1	1
60	Tetracycline	=	32	8	32	1
60	Tigecycline	=	0,12	0,03	0,12	1
60	Vancomycin	=	4	1	4	1
64	Ampicillin		1	0,5	2	1
64	Chloramphenicol	<=	4	4	16	1
64	Ciprofloxacin		1	0,25	2	1
64	Daptomycin		2	1	4	1
64	Erythromycin	<=	1	1	4	1
64	Gentamicin	<=	8	4	16	1
64	Linezolid		2	1	4	1

64	Teicoplanin	<=	0,5	0,25	1	1
64	Tetracycline		32	8	32	1
64	Tigecycline		0,06	0,03	0,12	1
64	Vancomycin		4	1	4	1

***Staphylococcus aureus* ATCC 29213**

Lab. code	Antimicrobial	Operator	Read_values	Min. value	Max. value	Score
2	Cefoxitin	=	4	1	4	1
2	Chloramphenicol	=	8	2	16	1
2	Ciprofloxacin	<=	0.25	0.12	0.5	1
2	Clindamycin	<=	0.12	0.06	0.25	1
2	Erythromycin	=	0.5	0.25	1	1
2	Fusidic acid	<=	0.5	0.06	0.25	1
2	Gentamicin	<=	1	0.12	1	1
2	Kanamycin	<=	4	1	4	1
2	Linezolid	=	2	1	4	1
2	Penicillin	=	0.5	0.25	2	1
2	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
2	Rifampicin	<=	0.016	0.004	0.016	1
2	Sulfamethoxazole	<=	64	32	128	1
2	Tetracycline	<=	0.5	0.12	1	1
2	Trimethoprim	<=	2	1	4	1
2	Vancomycin	<=	1	0.5	2	1
4	Cefoxitin		4	1	4	1
4	Chloramphenicol		16	2	16	1
4	Ciprofloxacin	<=	0.25	0.12	0.5	1
4	Clindamycin	<=	0.12	0.06	0.25	1
4	Erythromycin		1	0.25	1	1
4	Fusidic acid	<=	0.5	0.06	0.25	1
4	Gentamicin	<=	1	0.12	1	1
4	Kanamycin	<=	4	1	4	1
4	Linezolid		4	1	4	1
4	Penicillin		0.5	0.25	2	1
4	Quinupristin/dalfopristin (Synercid)		0.5	0.25	1	1
4	Rifampicin	<=	0.016	0.004	0.016	1
4	Sulfamethoxazole	<=	64	32	128	1
4	Tetracycline		1	0.12	1	1
4	Trimethoprim	<=	2	1	4	1
4	Vancomycin	<=	1	0.5	2	1
9	Cefoxitin	=	2	1	4	1
9	Chloramphenicol	<=	4	2	16	1
9	Ciprofloxacin	<=	0.25	0.12	0.5	1
9	Clindamycin	<=	0.12	0.06	0.25	1
9	Erythromycin	=	0.5	0.25	1	1
9	Gentamicin	<=	1	0.12	1	1
9	Linezolid	=	2	1	4	1
9	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
9	Sulfamethoxazole	<=	64	32	128	1
9	Tetracycline	<=	0.5	0.12	1	1
9	Trimethoprim	<=	2	1	4	1
9	Vancomycin	<=	1	0.5	2	1
11	Cefoxitin	=	4	1	4	1
11	Chloramphenicol	<=	4	2	16	1
11	Ciprofloxacin	=	0.5	0.12	0.5	1
11	Clindamycin	<=	0.12	0.06	0.25	1
11	Erythromycin	=	0.5	0.25	1	1

11	Fusidic acid	<=	0.5	0.06	0.25	1
11	Gentamicin	<=	1	0.12	1	1
11	Kanamycin	<=	4	1	4	1
11	Linezolid	=	2	1	4	1
11	Penicillin	=	0.25	0.25	2	1
11	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
11	Rifampicin	<=	0.016	0.004	0.016	1
11	Sulfamethoxazole	<=	64	32	128	1
11	Tetracycline	<=	0.5	0.12	1	1
11	Trimethoprim	=	4	1	4	1
11	Vancomycin	<=	1	0.5	2	1
12	Cefoxitin	=	4	1	4	1
12	Chloramphenicol	=	8	2	16	1
12	Ciprofloxacin	<=	0.25	0.12	0.5	1
12	Clindamycin	<=	0.12	0.06	0.25	1
12	Erythromycin	=	0.5	0.25	1	1
12	Fusidic acid	<=	0.5	0.06	0.25	1
12	Gentamicin	<=	1	0.12	1	1
12	Kanamycin	<=	4	1	4	1
12	Linezolid	=	2	1	4	1
12	Penicillin	=	1	0.25	2	1
12	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
12	Rifampicin	<=	0.016	0.004	0.016	1
12	Sulfamethoxazole	<=	64	32	128	1
12	Tetracycline	=	1	0.12	1	1
12	Trimethoprim	<=	2	1	4	1
12	Vancomycin	<=	1	0.5	2	1
17	Cefoxitin	=	4	1	4	1
17	Chloramphenicol	<=	4	2	16	1
17	Ciprofloxacin	=	0.5	0.12	0.5	1
17	Clindamycin	<=	0.12	0.06	0.25	1
17	Erythromycin	=	0.5	0.25	1	1
17	Fusidic acid	<=	0.5	0.06	0.25	1
17	Gentamicin	<=	1	0.12	1	1
17	Kanamycin	<=	4	1	4	1
17	Linezolid	<=	1	1	4	1
17	Penicillin	=	1	0.25	2	1
17	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
17	Rifampicin	<=	0.016	0.004	0.016	1
17	Sulfamethoxazole	<=	64	32	128	1
17	Tetracycline	<=	0.5	0.12	1	1
17	Trimethoprim	<=	2	1	4	1
17	Vancomycin	<=	1	0.5	2	1
20	Cefoxitin	=	4	1	4	1
20	Chloramphenicol	=	16	2	16	1
20	Ciprofloxacin	=	0.5	0.12	0.5	1
20	Clindamycin	<=	0.12	0.06	0.25	1
20	Erythromycin	=	0.5	0.25	1	1
20	Fusidic acid	<=	0.5	0.06	0.25	1
20	Gentamicin	<=	1	0.12	1	1
20	Kanamycin	<=	4	1	4	1

20	Linezolid	=	4	1	4	1
20	Penicillin	=	0.5	0.25	2	1
20	Quinupristin/dalfopristin (Synercid)	=	1	0.25	1	1
20	Rifampicin	<=	0.016	0.004	0.016	1
20	Sulfamethoxazole	<=	64	32	128	1
20	Tetracycline	=	1	0.12	1	1
20	Trimethoprim	=	4	1	4	1
20	Vancomycin	<=	1	0.5	2	1
21	Cefoxitin	=	4	1	4	1
21	Chloramphenicol	=	8	2	16	1
21	Ciprofloxacin	=	0.5	0.12	0.5	1
21	Clindamycin	<=	0.12	0.06	0.25	1
21	Erythromycin	=	0.5	0.25	1	1
21	Fusidic acid	<=	0.5	0.06	0.25	1
21	Gentamicin	<=	1	0.12	1	1
21	Kanamycin	<=	4	1	4	1
21	Linezolid	=	2	1	4	1
21	Penicillin	=	0.5	0.25	2	1
21	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
21	Rifampicin	<=	0.016	0.004	0.016	1
21	Sulfamethoxazole	<=	64	32	128	1
21	Tetracycline	<=	0.5	0.12	1	1
21	Trimethoprim	<=	2	1	4	1
21	Vancomycin	<=	1	0.5	2	1
22	Cefoxitin	=	2	1	4	1
22	Chloramphenicol	=	8	2	16	1
22	Ciprofloxacin	=	0.5	0.12	0.5	1
22	Clindamycin	<=	0.12	0.06	0.25	1
22	Erythromycin	=	0.5	0.25	1	1
22	Fusidic acid	<=	0.5	0.06	0.25	1
22	Gentamicin	<=	1	0.12	1	1
22	Kanamycin	<=	4	1	4	1
22	Linezolid	=	2	1	4	1
22	Penicillin	<=	0.12	0.25	2	0
22	Quinupristin/dalfopristin (Synercid)	=	1	0.25	1	1
22	Rifampicin	<=	0.016	0.004	0.016	1
22	Sulfamethoxazole	<=	64	32	128	1
22	Tetracycline	<=	0.5	0.12	1	1
22	Trimethoprim	<=	2	1	4	1
22	Vancomycin	<=	1	0.5	2	1
23	Cefoxitin		4	1	4	1
23	Chloramphenicol		8	2	16	1
23	Ciprofloxacin	<=	0.25	0.12	0.5	1
23	Clindamycin	<=	0.12	0.06	0.25	1
23	Erythromycin		0.5	0.25	1	1
23	Gentamicin	<=	1	0.12	1	1
23	Linezolid		2	1	4	1
23	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
23	Sulfamethoxazole	<=	64	32	128	1
23	Tetracycline	<=	0.5	0.12	1	1
23	Trimethoprim	<=	2	1	4	1

23	Vancomycin	<=	1	0.5	2	1
25	Chloramphenicol	=	16	2	16	1
25	Ciprofloxacin	=	0.25	0.12	0.5	1
25	Clindamycin	<=	0.25	0.06	0.25	1
25	Erythromycin	=	0.5	0.25	1	1
25	Fusidic acid	<=	0.25	0.06	0.25	1
25	Gentamicin	<=	0.5	0.12	1	1
25	Linezolid	=	4	1	4	1
25	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
25	Rifampicin	<=	0.25	0.004	0.016	1
25	Tetracycline	=	1	0.12	1	1
25	Vancomycin	<=	1	0.5	2	1
26	Cefoxitin	=	4	1	4	1
26	Chloramphenicol	=	8	2	16	1
26	Ciprofloxacin	<=	0.25	0.12	0.5	1
26	Clindamycin	<=	0.12	0.06	0.25	1
26	Erythromycin	=	0.5	0.25	1	1
26	Fusidic acid	<=	0.5	0.06	0.25	1
26	Gentamicin	<=	1	0.12	1	1
26	Kanamycin	<=	4	1	4	1
26	Linezolid	=	2	1	4	1
26	Penicillin	=	0.5	0.25	2	1
26	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
26	Rifampicin	<=	0.016	0.004	0.016	1
26	Sulfamethoxazole	<=	64	32	128	1
26	Tetracycline	<=	0.5	0.12	1	1
26	Trimethoprim	<=	2	1	4	1
26	Vancomycin	<=	1	0.5	2	1
29	Cefoxitin	=	4	1	4	1
29	Chloramphenicol	<=	4	2	16	1
29	Ciprofloxacin	<=	0.25	0.12	0.5	1
29	Clindamycin	<=	0.12	0.06	0.25	1
29	Erythromycin	=	0.5	0.25	1	1
29	Gentamicin	<=	1	0.12	1	1
29	Linezolid	<=	1	1	4	1
29	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
29	Sulfamethoxazole	<=	64	32	128	1
29	Tetracycline	<=	0.5	0.12	1	1
29	Trimethoprim	<=	2	1	4	1
29	Vancomycin	<=	1	0.5	2	1
30	Cefoxitin	=	4	1	4	1
30	Chloramphenicol	<=	4	2	16	1
30	Ciprofloxacin	<=	0.25	0.12	0.5	1
30	Clindamycin	<=	0.12	0.06	0.25	1
30	Erythromycin	=	0.5	0.25	1	1
30	Fusidic acid	<=	0.5	0.06	0.25	1
30	Gentamicin	<=	1	0.12	1	1
30	Kanamycin	<=	4	1	4	1
30	Linezolid	=	2	1	4	1
30	Penicillin	<=	0.12	0.25	2	0
30	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1

30	Rifampicin	<=	0.016	0.004	0.016	1
30	Sulfamethoxazole	<=	64	32	128	1
30	Tetracycline	<=	0.5	0.12	1	1
30	Trimethoprim	<=	2	1	4	1
30	Vancomycin	<=	1	0.5	2	1
31	Cefoxitin	<=	4	1	4	1
31	Chloramphenicol	<=	16	2	16	1
31	Ciprofloxacin	=	0.25	0.12	0.5	1
31	Clindamycin	<=	0.25	0.06	0.25	1
31	Erythromycin	<=	0.5	0.25	1	1
31	Fusidic acid	<=	0.5	0.06	0.25	1
31	Gentamicin	<=	2	0.12	1	1
31	Kanamycin	<=	8	1	4	1
31	Linezolid	<=	1	1	4	1
31	Penicillin	=	8	0.25	2	0
31	Quinupristin/dalfopristin (Synercid)	<=	1	0.25	1	1
31	Rifampicin	<=	0.032	0.004	0.016	1
31	Sulfamethoxazole	<=	128	32	128	1
31	Tetracycline	<=	1	0.12	1	1
31	Trimethoprim	<=	2	1	4	1
31	Vancomycin	<=	2	0.5	2	1
33	Cefoxitin	=	4	1	4	1
33	Chloramphenicol	=	8	2	16	1
33	Ciprofloxacin	=	0.25	0.12	0.5	1
33	Clindamycin	<=	0.25	0.06	0.25	1
33	Erythromycin	=	0.5	0.25	1	1
33	Fusidic acid	<=	0.25	0.06	0.25	1
33	Gentamicin	=	0.5	0.12	1	1
33	Linezolid	=	2	1	4	1
33	Penicillin	=	0.5	0.25	2	1
33	Tetracycline	<=	0.5	0.12	1	1
33	Trimethoprim	=	1	1	4	1
34	Cefoxitin	=	2	1	4	1
34	Chloramphenicol	=	8	2	16	1
34	Ciprofloxacin	<=	0.25	0.12	0.5	1
34	Clindamycin	<=	0.12	0.06	0.25	1
34	Erythromycin	=	0.5	0.25	1	1
34	Fusidic acid	<=	0.5	0.06	0.25	1
34	Gentamicin	<=	1	0.12	1	1
34	Kanamycin	<=	4	1	4	1
34	Linezolid	=	2	1	4	1
34	Penicillin	=	0.25	0.25	2	1
34	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
34	Rifampicin	<=	0.016	0.004	0.016	1
34	Sulfamethoxazole	<=	64	32	128	1
34	Tetracycline	<=	0.5	0.12	1	1
34	Trimethoprim	<=	2	1	4	1
34	Vancomycin	<=	1	0.5	2	1
36	Cefoxitin	=	4	1	4	1
36	Chloramphenicol	=	8	2	16	1
36	Ciprofloxacin	=	1	0.12	0.5	0

36	Clindamycin	=	0.25	0.06	0.25	1
36	Erythromycin	=	0.5	0.25	1	1
36	Fusidic acid	<=	0.5	0.06	0.25	1
36	Gentamicin	<=	1	0.12	1	1
36	Kanamycin	<=	4	1	4	1
36	Linezolid	=	4	1	4	1
36	Penicillin	=	32	0.25	2	0
36	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
36	Rifampicin	<=	0.016	0.004	0.016	1
36	Sulfamethoxazole	<=	64	32	128	1
36	Tetracycline	=	1	0.12	1	1
36	Trimethoprim	<=	2	1	4	1
36	Vancomycin	<=	1	0.5	2	1
39	Cefoxitin	=	2	1	4	1
39	Chloramphenicol	=	8	2	16	1
39	Ciprofloxacin	<=	0.25	0.12	0.5	1
39	Clindamycin	<=	0.12	0.06	0.25	1
39	Erythromycin	=	0.5	0.25	1	1
39	Gentamicin	<=	1	0.12	1	1
39	Linezolid	=	2	1	4	1
39	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
39	Sulfamethoxazole	<=	64	32	128	1
39	Tetracycline	<=	0.5	0.12	1	1
39	Trimethoprim	<=	2	1	4	1
39	Vancomycin	<=	1	0.5	2	1
40	Cefoxitin	=	2	1	4	1
40	Chloramphenicol	=	8	2	16	1
40	Ciprofloxacin	=	0.25	0.12	0.5	1
40	Clindamycin	=	0.12	0.06	0.25	1
40	Erythromycin	=	0.5	0.25	1	1
40	Fusidic acid	=	0.25	0.06	0.25	1
40	Gentamicin	=	1	0.12	1	1
40	Kanamycin	=	4	1	4	1
40	Linezolid	=	2	1	4	1
40	Penicillin	=	0.5	0.25	2	1
40	Quinupristin/dalfopristin (Synercid)	=	1	0.25	1	1
40	Rifampicin	=	0.016	0.004	0.016	1
40	Sulfamethoxazole	=	128	32	128	1
40	Tetracycline	=	0.5	0.12	1	1
40	Trimethoprim	=	2	1	4	1
40	Vancomycin	=	1	0.5	2	1
41	Cefoxitin	=	1	1	4	1
41	Chloramphenicol	=	8	2	16	1
41	Ciprofloxacin	<=	0.25	0.12	0.5	1
41	Clindamycin	=	0.25	0.06	0.25	1
41	Erythromycin	=	0.5	0.25	1	1
41	Gentamicin	<=	1	0.12	1	1
41	Kanamycin	<=	4	1	4	1
41	Linezolid	=	2	1	4	1
41	Penicillin	<=	0.12	0.25	2	0
41	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1

41	Rifampicin	<=	0.016	0.004	0.016	1
41	Sulfamethoxazole	<=	64	32	128	1
41	Tetracycline	<=	0.5	0.12	1	1
41	Trimethoprim	<=	2	1	4	1
41	Vancomycin	<=	1	0.5	2	1
42	Cefoxitin	=	4	1	4	1
42	Chloramphenicol	=	8	2	16	1
42	Ciprofloxacin	<=	0.25	0.12	0.5	1
42	Clindamycin	<=	0.12	0.06	0.25	1
42	Erythromycin	=	0.5	0.25	1	1
42	Fusidic acid	<=	0.5	0.06	0.25	1
42	Gentamicin	<=	1	0.12	1	1
42	Kanamycin	<=	4	1	4	1
42	Linezolid	=	2	1	4	1
42	Penicillin	<=	0.12	0.25	2	0
42	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
42	Rifampicin	<=	0.016	0.004	0.016	1
42	Sulfamethoxazole	<=	64	32	128	1
42	Tetracycline	<=	0.5	0.12	1	1
42	Trimethoprim	<=	2	1	4	1
42	Vancomycin	<=	1	0.5	2	1
45	Cefoxitin	=	4	1	4	1
45	Chloramphenicol	=	8	2	16	1
45	Ciprofloxacin	=	0.5	0.12	0.5	1
45	Clindamycin	<=	0.12	0.06	0.25	1
45	Erythromycin	=	0.5	0.25	1	1
45	Fusidic acid	<=	0.5	0.06	0.25	1
45	Gentamicin	<=	1	0.12	1	1
45	Kanamycin	<=	4	1	4	1
45	Linezolid	=	2	1	4	1
45	Penicillin	=	0.25	0.25	2	1
45	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
45	Rifampicin	<=	0.016	0.004	0.016	1
45	Sulfamethoxazole	=	128	32	128	1
45	Tetracycline	<=	0.5	0.12	1	1
45	Trimethoprim	<=	2	1	4	1
45	Vancomycin	<=	1	0.5	2	1
56	Cefoxitin	=	2	1	4	1
56	Chloramphenicol	=	8	2	16	1
56	Ciprofloxacin	<=	0.25	0.12	0.5	1
56	Clindamycin	<=	0.12	0.06	0.25	1
56	Erythromycin	=	0.5	0.25	1	1
56	Fusidic acid	<=	0.5	0.06	0.25	1
56	Gentamicin	<=	1	0.12	1	1
56	Kanamycin	<=	4	1	4	1
56	Linezolid	=	2	1	4	1
56	Penicillin	=	0.25	0.25	2	1
56	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
56	Rifampicin	<=	0.016	0.004	0.016	1
56	Sulfamethoxazole	<=	64	32	128	1
56	Tetracycline	<=	0.5	0.12	1	1

56	Trimethoprim	<=	2	1	4	1
56	Vancomycin	<=	1	0.5	2	1
59	Cefoxitin	=	4	1	4	1
59	Chloramphenicol	=	8	2	16	1
59	Ciprofloxacin	<=	0.25	0.12	0.5	1
59	Clindamycin	<=	0.12	0.06	0.25	1
59	Erythromycin	=	0.5	0.25	1	1
59	Fusidic acid	<=	0.5	0.06	0.25	1
59	Gentamicin	<=	1	0.12	1	1
59	Kanamycin	<=	4	1	4	1
59	Linezolid	=	2	1	4	1
59	Penicillin	=	0.5	0.25	2	1
59	Quinupristin/dalfopristin (Synercid)	<=	0.5	0.25	1	1
59	Rifampicin	<=	0.016	0.004	0.016	1
59	Sulfamethoxazole	<=	64	32	128	1
59	Tetracycline	<=	0.5	0.12	1	1
59	Trimethoprim	<=	2	1	4	1
59	Vancomycin	<=	1	0.5	2	1

***Escherichia coli* ATCC 25922**

Lab. code	Antimicrobial	Operator	Read_values	Min. value	Max. value	Score
2	Ampicillin	=	8	2.0	8.0	1
2	Cefepime	<=	0.06	0.016	0.12	1
2	Cefotaxime	<=	0.25	0.03	0.12	1
2	Cefotaxime	<=	0.25	0.03	0.12	1
2	Cefoxitin	=	4	2.0	8.0	1
2	Ceftazidime	<=	0.5	0.06	0.5	1
2	Ceftazidime	=	0.25	0.06	0.5	1
2	Chloramphenicol	<=	8	2.0	8.0	1
2	Ciprofloxacin	<=	0.015	0.004	0.016	1
2	Colistin	<=	1	0.25	2.0	1
2	Ertapenem	<=	0.015	0.004	0.016	1
2	Gentamicin	<=	0.5	0.25	1.0	1
2	Imipenem	<=	0.12	0.06	0.25	1
2	Meropenem	<=	0.03	0.008	0.06	1
2	Meropenem	<=	0.03	0.008	0.06	1
2	Nalidixic acid	<=	4	1.0	4.0	1
2	Sulfamethoxazole	=	32	8.0	32.0	1
2	Tetracycline	<=	2	0.5	2.0	1
2	Tigecycline	<=	0.25	0.03	0.25	1
2	Trimethoprim	=	0.5	0.5	2.0	1
4	Ampicillin		8	2.0	8.0	1
4	Cefepime	<=	0.06	0.016	0.12	1
4	Cefotaxime	<=	0.25	0.03	0.12	1
4	Cefotaxime	<=	0.25	0.03	0.12	1
4	Cefoxitin		4	2.0	8.0	1
4	Ceftazidime	<=	0.5	0.06	0.5	1
4	Ceftazidime	<=	0.25	0.06	0.5	1
4	Chloramphenicol	<=	8	2.0	8.0	1
4	Ciprofloxacin	<=	0.015	0.004	0.016	1
4	Colistin	<=	1	0.25	2.0	1
4	Ertapenem	<=	0.015	0.004	0.016	1
4	Gentamicin	<=	0.5	0.25	1.0	1
4	Imipenem		0.25	0.06	0.25	1
4	Meropenem	<=	0.03	0.008	0.06	1
4	Meropenem	<=	0.03	0.008	0.06	1
4	Nalidixic acid	<=	4	1.0	4.0	1
4	Sulfamethoxazole		32	8.0	32.0	1
4	Tetracycline	<=	2	0.5	2.0	1
4	Tigecycline	<=	0.25	0.03	0.25	1
4	Trimethoprim		1	0.5	2.0	1
6	Ampicillin	=	8	2.0	8.0	1
6	Cefepime	<=	0.06	0.016	0.12	1
6	Cefotaxime	<=	0.25	0.03	0.12	1
6	Cefotaxime	<=	0.25	0.03	0.12	1
6	Cefoxitin	=	8	2.0	8.0	1
6	Ceftazidime	<=	0.5	0.06	0.5	1
6	Ceftazidime	<=	0.25	0.06	0.5	1
6	Chloramphenicol	<=	8	2.0	8.0	1
6	Ciprofloxacin	<=	0.015	0.004	0.016	1

6	Colistin	<=	1	0.25	2.0	1
6	Ertapenem	<=	0.015	0.004	0.016	1
6	Gentamicin	=	1	0.25	1.0	1
6	Imipenem	<=	0.12	0.06	0.25	1
6	Meropenem	<=	0.03	0.008	0.06	1
6	Meropenem	<=	0.03	0.008	0.06	1
6	Nalidixic acid	<=	4	1.0	4.0	1
6	Sulfamethoxazole	=	32	8.0	32.0	1
6	Tetracycline	<=	2	0.5	2.0	1
6	Tigecycline	<=	0.25	0.03	0.25	1
6	Trimethoprim	=	1	0.5	2.0	1
9	Ampicillin	=	4	2.0	8.0	1
9	Cefepime	=	0.06	0.016	0.12	1
9	Cefotaxime	<=	0.25	0.03	0.12	1
9	Cefoxitin	=	4	2.0	8.0	1
9	Ceftazidime	<=	0.5	0.06	0.5	1
9	Ceftazidime	<=	0.25	0.06	0.5	1
9	Chloramphenicol	<=	8	2.0	8.0	1
9	Ciprofloxacin	<=	0.015	0.004	0.016	1
9	Colistin	<=	1	0.25	2.0	1
9	Ertapenem	<=	0.015	0.004	0.016	1
9	Gentamicin	<=	0.5	0.25	1.0	1
9	Imipenem	<=	0.12	0.06	0.25	1
9	Meropenem	<=	0.03	0.008	0.06	1
9	Meropenem	<=	0.03	0.008	0.06	1
9	Nalidixic acid	<=	4	1.0	4.0	1
9	Sulfamethoxazole	=	16	8.0	32.0	1
9	Tetracycline	<=	2	0.5	2.0	1
9	Tigecycline	<=	0.25	0.03	0.25	1
9	Trimethoprim	=	1	0.5	2.0	1
11	Ampicillin	=	4	2.0	8.0	1
11	Cefepime	<=	0.06	0.016	0.12	1
11	Cefotaxime	<=	0.25	0.03	0.12	1
11	Cefotaxime	<=	0.25	0.03	0.12	1
11	Cefoxitin	=	4	2.0	8.0	1
11	Ceftazidime	<=	0.5	0.06	0.5	1
11	Ceftazidime	<=	0.25	0.06	0.5	1
11	Chloramphenicol	<=	8	2.0	8.0	1
11	Ciprofloxacin	<=	0.015	0.004	0.016	1
11	Colistin	<=	1	0.25	2.0	1
11	Ertapenem	<=	0.015	0.004	0.016	1
11	Gentamicin	<=	0.5	0.25	1.0	1
11	Imipenem	<=	0.12	0.06	0.25	1
11	Meropenem	<=	0.03	0.008	0.06	1
11	Meropenem	<=	0.03	0.008	0.06	1
11	Nalidixic acid	<=	4	1.0	4.0	1
11	Sulfamethoxazole	=	16	8.0	32.0	1
11	Tetracycline	<=	2	0.5	2.0	1
11	Tigecycline	<=	0.25	0.03	0.25	1
11	Trimethoprim	=	0.5	0.5	2.0	1
12	Ampicillin	=	2	2.0	8.0	1

12	Cefepime	<=	0.06	0.016	0.12	1
12	Cefotaxime	<=	0.25	0.03	0.12	1
12	Cefotaxime	<=	0.25	0.03	0.12	1
12	Cefoxitin	=	2	2.0	8.0	1
12	Ceftazidime	<=	0.5	0.06	0.5	1
12	Ceftazidime	<=	0.25	0.06	0.5	1
12	Chloramphenicol	<=	8	2.0	8.0	1
12	Ciprofloxacin	<=	0.015	0.004	0.016	1
12	Colistin	<=	1	0.25	2.0	1
12	Ertapenem	<=	0.015	0.004	0.016	1
12	Gentamicin	<=	0.5	0.25	1.0	1
12	Imipenem	=	0.25	0.06	0.25	1
12	Meropenem	<=	0.03	0.008	0.06	1
12	Meropenem	<=	0.03	0.008	0.06	1
12	Nalidixic acid	<=	4	1.0	4.0	1
12	Sulfamethoxazole	=	16	8.0	32.0	1
12	Tetracycline	<=	2	0.5	2.0	1
12	Tigecycline	<=	0.25	0.03	0.25	1
12	Trimethoprim	=	0.5	0.5	2.0	1
16	Ampicillin	=	4	2.0	8.0	1
16	Cefepime	<=	0.06	0.016	0.12	1
16	Cefotaxime	<=	0.25	0.03	0.12	1
16	Cefotaxime	<=	0.25	0.03	0.12	1
16	Cefoxitin	=	4	2.0	8.0	1
16	Ceftazidime	<=	0.5	0.06	0.5	1
16	Ceftazidime	<=	0.25	0.06	0.5	1
16	Chloramphenicol	<=	8	2.0	8.0	1
16	Ciprofloxacin	<=	0.015	0.004	0.016	1
16	Colistin	<=	1	0.25	2.0	1
16	Ertapenem	<=	0.015	0.004	0.016	1
16	Gentamicin	<=	0.5	0.25	1.0	1
16	Imipenem	<=	0.12	0.06	0.25	1
16	Meropenem	<=	0.03	0.008	0.06	1
16	Meropenem	<=	0.03	0.008	0.06	1
16	Nalidixic acid	<=	4	1.0	4.0	1
16	Sulfamethoxazole	=	16	8.0	32.0	1
16	Tetracycline	<=	2	0.5	2.0	1
16	Tigecycline	<=	0.25	0.03	0.25	1
16	Trimethoprim	=	0.5	0.5	2.0	1
17	Ampicillin	=	8	2.0	8.0	1
17	Cefepime	<=	0.06	0.016	0.12	1
17	Cefotaxime	<=	0.25	0.03	0.12	1
17	Cefotaxime	<=	0.25	0.03	0.12	1
17	Cefoxitin	=	4	2.0	8.0	1
17	Ceftazidime	<=	0.5	0.06	0.5	1
17	Ceftazidime	<=	0.25	0.06	0.5	1
17	Chloramphenicol	<=	8	2.0	8.0	1
17	Ciprofloxacin	<=	0.015	0.004	0.016	1
17	Colistin	<=	1	0.25	2.0	1
17	Ertapenem	<=	0.015	0.004	0.016	1
17	Gentamicin	<=	0.5	0.25	1.0	1

17	Imipenem	<=	0.12	0.06	0.25	1
17	Meropenem	<=	0.03	0.008	0.06	1
17	Meropenem	<=	0.03	0.008	0.06	1
17	Nalidixic acid	<=	4	1.0	4.0	1
17	Sulfamethoxazole	=	16	8.0	32.0	1
17	Tetracycline	<=	2	0.5	2.0	1
17	Tigecycline	<=	0.25	0.03	0.25	1
17	Trimethoprim	=	0.5	0.5	2.0	1
18	Ampicillin	=	4	2.0	8.0	1
18	Cefepime	<=	0.06	0.016	0.12	1
18	Cefotaxime	<=	0.25	0.03	0.12	1
18	Cefotaxime	<=	0.25	0.03	0.12	1
18	Cefoxitin	=	4	2.0	8.0	1
18	Ceftazidime	<=	0.5	0.06	0.5	1
18	Ceftazidime	<=	0.25	0.06	0.5	1
18	Chloramphenicol	<=	8	2.0	8.0	1
18	Ciprofloxacin	<=	0.015	0.004	0.016	1
18	Colistin	<=	1	0.25	2.0	1
18	Ertapenem	<=	0.015	0.004	0.016	1
18	Gentamicin	<=	0.5	0.25	1.0	1
18	Imipenem	<=	0.12	0.06	0.25	1
18	Meropenem	<=	0.03	0.008	0.06	1
18	Meropenem	<=	0.03	0.008	0.06	1
18	Nalidixic acid	<=	4	1.0	4.0	1
18	Sulfamethoxazole	=	32	8.0	32.0	1
18	Tetracycline	<=	2	0.5	2.0	1
18	Tigecycline	<=	0.25	0.03	0.25	1
18	Trimethoprim	<=	0.25	0.5	2.0	0
19	Ampicillin	=	8	2.0	8.0	1
19	Cefepime	<=	0.06	0.016	0.12	1
19	Cefotaxime	<=	0.25	0.03	0.12	1
19	Cefotaxime	<=	0.25	0.03	0.12	1
19	Cefoxitin	=	4	2.0	8.0	1
19	Ceftazidime	<=	0.5	0.06	0.5	1
19	Ceftazidime	<=	0.25	0.06	0.5	1
19	Chloramphenicol	<=	8	2.0	8.0	1
19	Ciprofloxacin	<=	0.015	0.004	0.016	1
19	Colistin	<=	1	0.25	2.0	1
19	Ertapenem	<=	0.015	0.004	0.016	1
19	Gentamicin	<=	0.5	0.25	1.0	1
19	Imipenem	<=	0.12	0.06	0.25	1
19	Meropenem	<=	0.03	0.008	0.06	1
19	Meropenem	<=	0.03	0.008	0.06	1
19	Nalidixic acid	<=	4	1.0	4.0	1
19	Sulfamethoxazole	=	32	8.0	32.0	1
19	Tetracycline	<=	2	0.5	2.0	1
19	Tigecycline	<=	0.25	0.03	0.25	1
19	Trimethoprim	=	0.5	0.5	2.0	1
20	Ampicillin	=	4	2.0	8.0	1
20	Cefepime	<=	0.06	0.016	0.12	1
20	Cefotaxime	<=	0.25	0.03	0.12	1

20	Cefotaxime	<=	0.25	0.03	0.12	1
20	Cefoxitin	=	4	2.0	8.0	1
20	Ceftazidime	<=	0.5	0.06	0.5	1
20	Ceftazidime	<=	0.25	0.06	0.5	1
20	Chloramphenicol	<=	8	2.0	8.0	1
20	Ciprofloxacin	<=	0.015	0.004	0.016	1
20	Colistin	<=	1	0.25	2.0	1
20	Ertapenem	<=	0.015	0.004	0.016	1
20	Gentamicin	<=	0.5	0.25	1.0	1
20	Imipenem	<=	0.12	0.06	0.25	1
20	Meropenem	<=	0.03	0.008	0.06	1
20	Meropenem	<=	0.03	0.008	0.06	1
20	Nalidixic acid	<=	4	1.0	4.0	1
20	Sulfamethoxazole	=	16	8.0	32.0	1
20	Tetracycline	<=	2	0.5	2.0	1
20	Tigecycline	<=	0.25	0.03	0.25	1
20	Trimethoprim	=	0.5	0.5	2.0	1
21	Ampicillin	=	4	2.0	8.0	1
21	Cefepime	<=	0.06	0.016	0.12	1
21	Cefotaxime	<=	0.25	0.03	0.12	1
21	Cefotaxime	<=	0.25	0.03	0.12	1
21	Cefoxitin	=	4	2.0	8.0	1
21	Ceftazidime	<=	0.5	0.06	0.5	1
21	Ceftazidime	<=	0.25	0.06	0.5	1
21	Chloramphenicol	<=	8	2.0	8.0	1
21	Ciprofloxacin	<=	0.015	0.004	0.016	1
21	Colistin	<=	1	0.25	2.0	1
21	Ertapenem	<=	0.015	0.004	0.016	1
21	Gentamicin	<=	0.5	0.25	1.0	1
21	Imipenem	<=	0.12	0.06	0.25	1
21	Meropenem	<=	0.03	0.008	0.06	1
21	Meropenem	<=	0.03	0.008	0.06	1
21	Nalidixic acid	<=	4	1.0	4.0	1
21	Sulfamethoxazole	=	32	8.0	32.0	1
21	Tetracycline	<=	2	0.5	2.0	1
21	Tigecycline	<=	0.25	0.03	0.25	1
21	Trimethoprim	=	0.5	0.5	2.0	1
22	Ampicillin	=	2	2.0	8.0	1
22	Cefepime	<=	0.06	0.016	0.12	1
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59	Cefotaxime	<=	0.25	0.03	0.12	1
59	Cefotaxime	<=	0.25	0.03	0.12	1
59	Cefoxitin	=	4	2.0	8.0	1
59	Ceftazidime	<=	0.5	0.06	0.5	1
59	Ceftazidime	=	0.5	0.06	0.5	1
59	Chloramphenicol	<=	8	2.0	8.0	1
59	Ciprofloxacin	<=	0.015	0.004	0.016	1
59	Colistin	<=	1	0.25	2.0	1
59	Ertapenem	<=	0.015	0.004	0.016	1
59	Gentamicin	<=	0.5	0.25	1.0	1
59	Imipenem	=	0.25	0.06	0.25	1
59	Meropenem	<=	0.03	0.008	0.06	1
59	Meropenem	<=	0.03	0.008	0.06	1
59	Nalidixic acid	<=	4	1.0	4.0	1
59	Sulfamethoxazole	=	16	8.0	32.0	1
59	Tetracycline	<=	2	0.5	2.0	1
59	Tigecycline	<=	0.25	0.03	0.25	1
59	Trimethoprim	=	0.5	0.5	2.0	1
60	Ampicillin	<=	0.25	2.0	8.0	0
60	Cefotaxime	<=	0.25	0.03	0.12	1
60	Ceftazidime	<=	0.5	0.06	0.5	1
60	Chloramphenicol	<=	8	2.0	8.0	1
60	Ciprofloxacin	<=	0.015	0.004	0.016	1
60	Colistin	<=	1	0.25	2.0	1
60	Gentamicin	<=	0.5	0.25	1.0	1
60	Meropenem	<=	0.03	0.008	0.06	1
60	Nalidixic acid	<=	4	1.0	4.0	1
60	Sulfamethoxazole	<=	2	8.0	32.0	0
60	Tetracycline	<=	0.25	0.5	2.0	0
60	Tigecycline	=	4	0.03	0.25	0
60	Trimethoprim	<=	8	0.5	2.0	1

Enterococci - summary of results

Antimicrobial	EURL ENT-12.1		EURL ENT-12.2		EURL ENT-12.3		EURL ENT-12.4		EURL ENT-12.5		EURL ENT-12.6		EURL ENT-12.7		EURL ENT-12.8	
	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested	Correct	Tested
Ampicillin AMP	24	27	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Chloramphenicol CHL	28	28	28	28	21	28	26	28	28	28	27	28	28	28	28	28
Ciprofloxacin CIP	28	28	28	28	28	28	28	28	28	28	8	28	28	28	28	28
Daptomycin DAP	28	28	28	28	28	28	27	28	4	28	27	27	28	28	26	28
Erythromycin ERY	27	28	28	28	28	28	28	28	27	28	28	28	28	28	28	28
Gentamicin GEN	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Linezolid LZD	28	28	28	28	27	28	28	28	28	28	28	28	28	28	27	28
Quinupristin/dalfopristin (Synercid) SYN	26	27	na	na	na	na	28	28	27	28	23	26	na	na	na	na
Teicoplanin TEI	28	28	28	28	28	28	28	28	27	28	28	28	28	28	28	28
Tetracycline TET	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Tigecycline TGC	25	27	24	27	25	28	25	28	26	28	25	27	25	27	22	28
Vancomycin VAN	27	28	28	28	28	28	27	28	27	28	28	28	28	28	28	28

Excluded from report ≥ 25% deviations)

Antimicrobial	EURL ENT-12.1		EURL ENT-12.2		EURL ENT-12.3		EURL ENT-12.4		EURL ENT-12.5		EURL ENT-12.6		EURL ENT-12.7		EURL ENT-12.8	
	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)	Deviations (no.)	Deviations (%)
Ampicillin AMP	3,0	11,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Chloramphenicol CHL	0,0	0,0	0,0	0,0	7,0	25,0	2,0	7,1	0,0	0,0	1,0	3,6	0,0	0,0	0,0	0,0
Ciprofloxacin CIP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	20,0	71,4	0,0	0,0	0,0	0,0
Daptomycin DAP	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,6	24,0	85,7	0,0	0,0	0,0	0,0	2,0	7,1
Erythromycin ERY	1,0	3,6	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,6	0,0	0,0	0,0	0,0	0,0	0,0
Gentamicin GEN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Linezolid LZD	0,0	0,0	0,0	0,0	1,0	3,6	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,6
Quinupristin/dalfopristin (Synercid) SYN	1,0	3,7	na	na	na	na	0,0	0,0	1,0	3,6	3,0	11,5	na	na	na	na
Teicoplanin TEI	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,6	0,0	0,0	0,0	0,0	0,0	0,0
Tetracycline TET	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Tigecycline TGC	2,0	7,4	3,0	11,1	3,0	10,7	3,0	10,7	2,0	7,1	2,0	7,4	2,0	7,4	6,0	21,4
Vancomycin VAN	1,0	3,6	0,0	0,0	0,0	0,0	1,0	3,6	1,0	3,6	0,0	0,0	0,0	0,0	0,0	0,0

Excluded from report (≥ 25% deviations)

na, not applicable

***Staphylococcus aureus* - summary of results**

ANTIMICROBIAL	EURL ST-12.1		EURL ST-12.2		EURL ST-12.3		EURL ST-12.4		EURL ST-12.5		EURL ST-12.6		EURL ST-12.7		EURL ST-12.8	
	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total
Cefoxitin FOX	24	24	24	24	23	24	24	24	23	24	23	24	24	24	22	24
Chloramphenicol CHL	25	25	25	25	25	25	25	25	25	25	24	25	25	25	25	25
Ciprofloxacin CIP	11	25	25	25	24	25	25	25	24	25	24	25	25	25	25	25
Clindamycin CLN	25	25	25	25	25	25	23	25	21	24	25	25	25	25	25	25
Erythromycin ERY	25	25	25	25	25	25	25	25	21	24	25	25	25	25	25	25
Fusidic acid FUS	24	24	23	24	24	24	24	24	24	24	24	24	24	24	23	24
Gentamicin GEN	25	25	25	25	25	25	25	25	25	25	24	25	25	25	25	25
Kanamycin KAN	22	22	22	22	22	22	22	22	20	22	22	22	22	22	22	22
Linezolid LZD	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Mupirocin MUP	23	23	22	23	23	23	23	23	23	23	23	23	23	23	23	23
Quinupristin/dalfopristin (Synercid) SYN	24	24	24	24	5	24	23	24	20	24	24	24	24	24	24	24
Rifampicin RIF	23	23	23	23	23	23	23	23	23	23	22	22	23	23	23	23
Streptomycin STR	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Sulfamethoxazole SMX	22	23	21	23	21	23	22	23	23	23	21	23	22	23	23	23
Tetracycline TET	25	25	25	25	25	25	24	25	25	25	25	25	24	25	25	25
Tiamulin TIA	23	23	23	23	23	23	23	23	22	23	23	23	23	23	23	23
Trimethoprim TMP	24	24	24	24	24	24	24	24	23	24	24	24	21	24	24	24
Vancomycin VAN	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24

Excluded from report ≥ 25% deviations)

ANTIMICROBIAL	EURL ST-12.1		EURL ST-12.2		EURL ST-12.3		EURL ST-12.4		EURL ST-12.5		EURL ST-12.6		EURL ST-12.7		EURL ST-12.8	
	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)
Cefoxitin FOX	0,0	0,0	0,0	0,0	1,0	4,2	0,0	0,0	1,0	4,2	1,0	4,2	0,0	0,0	2,0	8,3
Chloramphenicol CHL	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	4,0	0,0	0,0	0,0	0,0
Ciprofloxacin CIP	14,0	56,0	0,0	0,0	1,0	4,0	0,0	0,0	1,0	4,0	1,0	4,0	0,0	0,0	0,0	0,0
Clindamycin CLN	0,0	0,0	0,0	0,0	0,0	0,0	2,0	8,0	3,0	12,5	0,0	0,0	0,0	0,0	0,0	0,0
Erythromycin ERY	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	3,0	12,5	0,0	0,0	0,0	0,0	0,0	0,0
Fusidic acid FUS	0,0	0,0	1,0	4,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	4,2
Gentamicin GEN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	4,0	0,0	0,0	0,0	0,0
Kanamycin KAN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,0	9,1	0,0	0,0	0,0	0,0	0,0	0,0
Linezolid LZD	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Mupirocin MUP	0,0	0,0	1,0	4,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Quinupristin/dalfopristin (Synercid) SYN	0,0	0,0	0,0	0,0	19,0	79,2	1,0	4,2	4,0	16,7	0,0	0,0	0,0	0,0	0,0	0,0
Rifampicin RIF	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Streptomycin STR	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Sulfamethoxazole SMX	1,0	4,3	2,0	8,7	2,0	8,7	1,0	4,3	0,0	0,0	2,0	8,7	1,0	4,3	0,0	0,0
Tetracycline TET	0,0	0,0	0,0	0,0	0,0	0,0	1,0	4,0	0,0	0,0	0,0	0,0	1,0	4,0	0,0	0,0
Tiamulin TIA	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	4,3	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim TMP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	4,2	0,0	0,0	3,0	12,5	0,0	0,0
Vancomycin VAN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Excluded from report ≥ 25% deviations)

Escherichia coli **- summary of results**

ANTIMICROBIAL	EURL EC-12.1		EURL EC-12.2		EURL EC-12.3		EURL EC-12.4		EURL EC-12.5		EURL EC-12.6		EURL EC-12.7		EURL EC-12.8	
	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total	Correct	Total
Ampicillin AMP	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Azithromycin AZI	32	32	32	32	30	32	32	32	32	32	32	32	32	32	30	32
Cefepime FEP	32	32	na	na	32	32	na	na	32	32	31	31	32	32	32	32
Cefotaxime FOT	64	64	31	32	64	64	31	32	64	64	63	63	64	64	64	64
Cefoxitin FOX	32	32	na	na	31	32	na	na	32	32	25	30	32	32	30	32
Ceftazidime TAZ	64	64	31	32	64	64	32	32	64	64	61	63	64	64	64	64
Chloramphenicol CHL	32	32	31	32	31	32	32	32	32	32	32	32	32	32	32	32
Ciprofloxacin CIP	32	32	32	32	32	32	32	32	32	32	32	32	31	32	31	32
Colistin COL	32	32	32	32	32	32	32	32	32	32	26	30	32	32	32	32
Ertapenem ETP	32	32	na	na	32	32	na	na	32	32	31	31	31	32	32	32
Gentamicin GEN	32	32	32	32	32	32	32	32	32	32	32	32	3	32	32	32
Imipenem IMI	32	32	na	na	32	32	na	na	32	32	18	29	22	31	32	32
Meropenem MERO	64	64	32	32	64	64	32	32	64	64	56	63	61	64	64	64
Nalidixic acid NAL	32	32	32	32	32	32	32	32	32	32	32	32	31	32	32	32
Sulfamethoxazole SMX	32	32	31	32	32	32	32	32	32	32	32	32	32	32	31	32
Tetracycline TET	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Tigecycline TGC	32	32	32	32	32	32	28	32	32	32	32	32	32	32	32	32
Trimethoprim TMP	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32

Excluded from the report (≥ 25% deviations)

ANTIMICROBIAL	EURL EC-12.1		EURL EC-12.2		EURL EC-12.3		EURL EC-12.4		EURL EC-12.5		EURL EC-12.6		EURL EC-12.7		EURL EC-12.8	
	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)	Deviation (no.)	Deviation (%)
Ampicillin AMP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Azithromycin AZI	0,0	0,0	0,0	0,0	2,0	6,3	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,0	6,3
Cefepime FEP	0,0	0,0	na	na	0,0	0,0	na	na	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Cefotaxime FOT	0,0	0,0	1,0	3,1	0,0	0,0	1,0	3,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Cefoxitin FOX	0,0	0,0	na	na	1,0	3,1	na	na	0,0	0,0	5,0	16,7	0,0	0,0	2,0	6,3
Ceftazidime TAZ	0,0	0,0	1,0	3,1	0,0	0,0	0,0	0,0	0,0	0,0	2,0	3,2	0,0	0,0	0,0	0,0
Chloramphenicol CHL	0,0	0,0	1,0	3,1	1,0	3,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Ciprofloxacin CIP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,1	1,0	3,1
Colistin COL	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	4,0	13,3	0,0	0,0	0,0	0,0
Ertapenem ETP	0,0	0,0	na	na	0,0	0,0	na	na	0,0	0,0	0,0	0,0	1,0	3,1	0,0	0,0
Gentamicin GEN	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	29,0	90,6	0,0	0,0
Imipenem IMI	0,0	0,0	na	na	0,0	0,0	na	na	0,0	0,0	11,0	37,9	9,0	29,0	0,0	0,0
Meropenem MERO	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	7,0	11,1	3,0	4,7	0,0	0,0
Nalidixic acid NAL	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,1	0,0	0,0
Sulfamethoxazole SMX	0,0	0,0	1,0	3,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,1
Tetracycline TET	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Tigecycline TGC	0,0	0,0	0,0	0,0	0,0	0,0	4,0	12,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Trimethoprim TMP	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Excluded from the report (≥ 25% deviations)

Enterococci - deviations

Lab code	Strain ID	Antimicrobial	Read_value	Exp_value	Interp.	Exp_interp.
22	EURL ENT-12.1	Ampicillin AMP	8	4	R	S
25	EURL ENT-12.1	Ampicillin AMP	8	4	R	S
34	EURL ENT-12.1	Ampicillin AMP	4	4	R	S
11	EURL ENT-12.1	Erythromycin ERY	16	2	R	S
22	EURL ENT-12.1	Quinupristin/dalfopristin (Synercid) SYN	8	4	R	S
34	EURL ENT-12.1	Tigecycline TGC	0,5	0,12	R	S
64	EURL ENT-12.1	Tigecycline TGC	0,5	0,12	R	S
64	EURL ENT-12.1	Vancomycin VAN	<= 1	> 128	S	R
34	EURL ENT-12.2	Tigecycline TGC	0,5	0,12	R	S
41	EURL ENT-12.2	Tigecycline TGC	0,5	0,12	R	S
64	EURL ENT-12.2	Tigecycline TGC	0,5	0,12	R	S
11	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
12	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
17	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
22	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
30	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
33	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
40	EURL ENT-12.3	Chloramphenicol CHL	32	64	S	R
17	EURL ENT-12.3	Linezolid LZD	2	8	S	R
34	EURL ENT-12.3	Tigecycline TGC	0,5	0,12	R	S
41	EURL ENT-12.3	Tigecycline TGC	0,5	0,12	R	S
64	EURL ENT-12.3	Tigecycline TGC	0,5	0,12	R	S
2	EURL ENT-12.4	Chloramphenicol CHL	32	32	R	S
34	EURL ENT-12.4	Chloramphenicol CHL	16	32	R	S
36	EURL ENT-12.4	Daptomycin DAP	8	4	R	S
17	EURL ENT-12.4	Tigecycline TGC	0,5	0,12	R	S
34	EURL ENT-12.4	Tigecycline TGC	0,5	0,12	R	S
41	EURL ENT-12.4	Tigecycline TGC	0,5	0,12	R	S
23	EURL ENT-12.4	Vancomycin VAN	> 128	> 128	S	R
2	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
4	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
11	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
12	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
16	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
17	EURL ENT-12.5	Daptomycin DAP	2	8	S	R
22	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
23	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
25	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
26	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
30	EURL ENT-12.5	Daptomycin DAP	2	8	S	R
32	EURL ENT-12.5	Daptomycin DAP	2	8	S	R
33	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
34	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
36	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
39	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
40	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
41	EURL ENT-12.5	Daptomycin DAP	1	8	S	R
42	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
45	EURL ENT-12.5	Daptomycin DAP	2	8	S	R
56	EURL ENT-12.5	Daptomycin DAP	1	8	S	R
59	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
60	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
64	EURL ENT-12.5	Daptomycin DAP	4	8	S	R
11	EURL ENT-12.5	Erythromycin ERY	16	2	R	S
64	EURL ENT-12.5	Quinupristin/dalfopristin (Synercid) SYN	2	4	R	S
39	EURL ENT-12.5	Teicoplanin TEI	16	1	R	S
34	EURL ENT-12.5	Tigecycline TGC	0,5	0,06	R	S
41	EURL ENT-12.5	Tigecycline TGC	0,5	0,06	R	S
41	EURL ENT-12.5	Vancomycin VAN	2	32	S	R
2	EURL ENT-12.6	Chloramphenicol CHL	32	16	R	S
2	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S

9	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
11	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
12	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
16	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
17	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
19	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
25	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
29	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
30	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
32	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
33	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
36	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
39	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
41	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
42	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
56	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
59	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
60	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
64	EURL ENT-12.6	Ciprofloxacin CIP	8	4	R	S
11	EURL ENT-12.6	Quinupristin/dalfopristin (Synercid) SYN	4	8	S	R
33	EURL ENT-12.6	Quinupristin/dalfopristin (Synercid) SYN	4	8	S	R
40	EURL ENT-12.6	Quinupristin/dalfopristin (Synercid) SYN	4	8	S	R
20	EURL ENT-12.6	Tigecycline TGC	0,5	0,12	R	S
41	EURL ENT-12.6	Tigecycline TGC	0,5	0,12	R	S
17	EURL ENT-12.7	Tigecycline TGC	0,5	0,12	R	S
34	EURL ENT-12.7	Tigecycline TGC	0,5	0,12	R	S
20	EURL ENT-12.8	Daptomycin DAP	8	4	R	S
42	EURL ENT-12.8	Daptomycin DAP	8	4	R	S
64	EURL ENT-12.8	Linezolid LZD	16	2	R	S
17	EURL ENT-12.8	Tigecycline TGC	0,5	0,12	R	S
20	EURL ENT-12.8	Tigecycline TGC	0,5	0,12	R	S
22	EURL ENT-12.8	Tigecycline TGC	0,5	0,12	R	S
26	EURL ENT-12.8	Tigecycline TGC	0,5	0,12	R	S
34	EURL ENT-12.8	Tigecycline TGC	1	0,12	R	S
45	EURL ENT-12.8	Tigecycline TGC	0,5	0,12	R	S

Excluded from the report (>25% deviations)

***Staphylococcus aureus* - deviations**

Lab code	Strain ID	Antimicrobial	Read_value	Exp_value	Interp.	Exp_interp.
4	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
9	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
11	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
12	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
17	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
20	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
22	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
23	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
26	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
29	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
31	EURL ST-12.1	Ciprofloxacin CIP	> 1.0	1	R	S
39	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
45	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
59	EURL ST-12.1	Ciprofloxacin CIP	= 2.0	1	R	S
31	EURL ST-12.1	Penicillin PEN	> 8.0	> 2	R	
11	EURL ST-12.1	Sulfamethoxazole SMX	= 128.0	512	S	R
40	EURL ST-12.2	Fusidic acid FUS	<= 2.0	<= 0.5	R	S
40	EURL ST-12.2	Mupirocin MUP	= 1.0	<= 0.5	R	S
31	EURL ST-12.2	Penicillin PEN	<= 0.12	<= 0.12	S	
36	EURL ST-12.2	Sulfamethoxazole SMX	> 512	<= 64.0	R	S
45	EURL ST-12.2	Sulfamethoxazole SMX	> 512	<= 64.0	R	S
34	EURL ST-12.3	Cefoxitin FOX	= 2.0	8	S	R
22	EURL ST-12.3	Ciprofloxacin CIP	= 8.0	8	S	R
2	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
4	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
9	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
11	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
12	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
17	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
20	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
21	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
22	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
23	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
25	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
26	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
29	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 4.0	1	R	S
30	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
36	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
40	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
45	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
56	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
59	EURL ST-12.3	Quinupristin/dalfopristin (Synercid) SYN	= 2.0	1	R	S
40	EURL ST-12.3	Sulfamethoxazole SMX	= 512.0	<= 64	R	S
45	EURL ST-12.3	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
25	EURL ST-12.4	Clindamycin CLN	= 1.0	1	S	R
34	EURL ST-12.4	Clindamycin CLN	= 0.25	1	S	R
31	EURL ST-12.4	Penicillin PEN	> 8.0	> 2	R	
56	EURL ST-12.4	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	2	S	R
45	EURL ST-12.4	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
39	EURL ST-12.4	Tetracycline TET	= 2.0	<= 0.5	R	S
39	EURL ST-12.5	Cefoxitin FOX	= 8.0	4	R	S

39	EURL ST-12.5	Ciprofloxacin CIP	= 8.0	= 0.5	R	S
17	EURL ST-12.5	Clindamycin CLN	<= 0.12	> 4	S	R
34	EURL ST-12.5	Clindamycin CLN	<= 0.12	> 4	S	R
56	EURL ST-12.5	Clindamycin CLN	= 0.25	> 4	S	R
17	EURL ST-12.5	Erythromycin ERY	<= 0.25	> 8	S	R
34	EURL ST-12.5	Erythromycin ERY	<= 0.25	> 8	S	R
56	EURL ST-12.5	Erythromycin ERY	= 0.5	> 8	S	R
4	EURL ST-12.5	Kanamycin KAN	= 16.0	8	R	S
26	EURL ST-12.5	Kanamycin KAN	= 16.0	8	R	S
17	EURL ST-12.5	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	2	S	R
30	EURL ST-12.5	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	2	S	R
34	EURL ST-12.5	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	2	S	R
56	EURL ST-12.5	Quinupristin/dalfopristin (Synercid) SYN	= 1.0	2	S	R
17	EURL ST-12.5	Tiamulin TIA	= 2.0	4	S	R
39	EURL ST-12.5	Trimethoprim TMP	> 32.0	<= 2	R	S
39	EURL ST-12.6	Cefoxitin FOX	> 4.0	2	R	S
39	EURL ST-12.6	Chloramphenicol CHL	> 16.0	8	R	S
39	EURL ST-12.6	Ciprofloxacin CIP	= 4.0	<= 0.25	R	S
39	EURL ST-12.6	Gentamicin GEN	= 4.0	<= 1	R	S
12	EURL ST-12.6	Sulfamethoxazole SMX	= 256.0	<= 64	R	S
45	EURL ST-12.6	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
45	EURL ST-12.7	Sulfamethoxazole SMX	> 512.0	<= 64	R	S
39	EURL ST-12.7	Tetracycline TET	> 16.0	<= 0.5	R	S
22	EURL ST-12.7	Trimethoprim TMP	= 4.0	<= 2	R	S
39	EURL ST-12.7	Trimethoprim TMP	= 4.0	<= 2	R	S
45	EURL ST-12.7	Trimethoprim TMP	= 4.0	<= 2	R	S
34	EURL ST-12.8	Cefoxitin FOX	= 2.0	8	S	R
39	EURL ST-12.8	Cefoxitin FOX	= 4.0	8	S	R
40	EURL ST-12.8	Fusidic acid FUS	= 2.0	<= 0.5	R	S

Excluded from the report (>25% deviations)

***Escherichia coli* - deviations**

Lab code	Strain ID	Antimicrobial	Read_value	Exp_value	Interp.	Exp_interp.
61	EURL EC-12.2	Cefotaxime FOT	1	<= 0.25	R	S
61	EURL EC-12.2	Ceftazidime TAZ	8	<= 0.5	R	S
61	EURL EC-12.2	Chloramphenicol CHL	32	<= 8	R	S
61	EURL EC-12.2	Sulfamethoxazole SMX	128	16	R	S
26	EURL EC-12.3	Azithromycin AZI	16	64	S	R
61	EURL EC-12.3	Azithromycin AZI	32	64	S	R
45	EURL EC-12.3	Cefoxitin FOX	16	8	R	S
40	EURL EC-12.3	Chloramphenicol CHL	<= 8	> 128	S	R
61	EURL EC-12.4	Cefotaxime FOT	0.5	<= 0.25	R	S
4	EURL EC-12.4	Tigecycline TGC	1	2	S	R
23	EURL EC-12.4	Tigecycline TGC	= 0.5	2	S	R
26	EURL EC-12.4	Tigecycline TGC	= 0.5	2	S	R
61	EURL EC-12.4	Tigecycline TGC	1	2	S	R
6	EURL EC-12.6	Cefoxitin FOX	16	8	R	S
22	EURL EC-12.6	Cefoxitin FOX	16	8	R	S
26	EURL EC-12.6	Cefoxitin FOX	16	8	R	S
33	EURL EC-12.6	Cefoxitin FOX	16	8	R	S
39	EURL EC-12.6	Cefoxitin FOX	16	8	R	S
22	EURL EC-12.6	Ceftazidime TAZ	= 0.5	= 0.5	R	S
45	EURL EC-12.6	Ceftazidime TAZ	1	<= 0.5	R	S
23	EURL EC-12.6	Colistin COL	2	4	S	R
33	EURL EC-12.6	Colistin COL	2	4	S	R
40	EURL EC-12.6	Colistin COL	2	4	S	R
45	EURL EC-12.6	Colistin COL	2	4	S	R
4	EURL EC-12.6	Imipenem IMI	0.25	2	S	R
11	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
19	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
20	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
21	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
26	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
34	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
40	EURL EC-12.6	Imipenem IMI	= 0.25	2	S	R
42	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
56	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
59	EURL EC-12.6	Imipenem IMI	= 0.5	2	S	R
4	EURL EC-12.6	Meropenem MERO	0.12	= 0.5	S	R
11	EURL EC-12.6	Meropenem MERO	= 0.12	= 0.5	S	R
11	EURL EC-12.6	Meropenem MERO	= 0.12	= 0.5	S	R
26	EURL EC-12.6	Meropenem MERO	= 0.12	= 0.5	S	R
26	EURL EC-12.6	Meropenem MERO	= 0.12	= 0.5	S	R
33	EURL EC-12.6	Meropenem MERO	= 0.12	= 0.5	S	R
33	EURL EC-12.6	Meropenem MERO	= 0.12	= 0.5	S	R
4	EURL EC-12.7	Ciprofloxacin CIP	0.12	<= 0.015	R	S
11	EURL EC-12.7	Ertapenem ETP	= 0.06	= 0.25	S	R
2	EURL EC-12.7	Gentamicin GEN	2	4	S	R
4	EURL EC-12.7	Gentamicin GEN	2	4	S	R
6	EURL EC-12.7	Gentamicin GEN	2	4	S	R
9	EURL EC-12.7	Gentamicin GEN	2	4	S	R
12	EURL EC-12.7	Gentamicin GEN	2	4	S	R

16	EURL EC-12.7	Gentamicin GEN	2	4	S	R
17	EURL EC-12.7	Gentamicin GEN	4	4	S	R
18	EURL EC-12.7	Gentamicin GEN	2	4	S	R
20	EURL EC-12.7	Gentamicin GEN	2	4	S	R
21	EURL EC-12.7	Gentamicin GEN	2	4	S	R
22	EURL EC-12.7	Gentamicin GEN	2	4	S	R
23	EURL EC-12.7	Gentamicin GEN	2	4	S	R
25	EURL EC-12.7	Gentamicin GEN	2	4	S	R
26	EURL EC-12.7	Gentamicin GEN	2	4	S	R
29	EURL EC-12.7	Gentamicin GEN	2	4	S	R
30	EURL EC-12.7	Gentamicin GEN	2	4	S	R
33	EURL EC-12.7	Gentamicin GEN	2	4	S	R
34	EURL EC-12.7	Gentamicin GEN	2	4	S	R
36	EURL EC-12.7	Gentamicin GEN	2	4	S	R
37	EURL EC-12.7	Gentamicin GEN	2	4	S	R
38	EURL EC-12.7	Gentamicin GEN	2	4	S	R
39	EURL EC-12.7	Gentamicin GEN	2	4	S	R
40	EURL EC-12.7	Gentamicin GEN	2	4	S	R
41	EURL EC-12.7	Gentamicin GEN	2	4	S	R
42	EURL EC-12.7	Gentamicin GEN	2	4	S	R
56	EURL EC-12.7	Gentamicin GEN	2	4	S	R
59	EURL EC-12.7	Gentamicin GEN	2	4	S	R
60	EURL EC-12.7	Gentamicin GEN	2	4	S	R
61	EURL EC-12.7	Gentamicin GEN	2	4	S	R
6	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
12	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
16	EURL EC-12.7	Imipenem IMI	= 0.5	= 0.5	R	S
18	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
19	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
37	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
41	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
45	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
60	EURL EC-12.7	Imipenem IMI	1	= 0.5	R	S
11	EURL EC-12.7	Meropenem MERO	= 0.12	= 0.25	S	R
11	EURL EC-12.7	Meropenem MERO	= 0.12	= 0.25	S	R
36	EURL EC-12.7	Meropenem MERO	= 0.12	= 0.25	S	R
4	EURL EC-12.7	Nalidixic acid NAL	64	<= 4	R	S
18	EURL EC-12.8	Azithromycin AZI	32	16	R	S
45	EURL EC-12.8	Azithromycin AZI	32	16	R	S
6	EURL EC-12.8	Cefoxitin FOX	16	8	R	S
22	EURL EC-12.8	Cefoxitin FOX	16	8	R	S
40	EURL EC-12.8	Ciprofloxacin CIP	= 0.03	= 0.5	S	R
42	EURL EC-12.8	Sulfamethoxazole SMX	> 1024	> 1024	S	R

Excluded from the report (>25% deviations)

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